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POST-WAR INDUSTRIAL RECONSTRUCTION

THE Government of India, in a communique dated 6th June 1941, have announced their decision to appoint a committee to consider post-war problems of Industrial reconstruction. This is a decision which will be warmly welcomed by every one interested in the industrial advancement of this country.

Since the commencement of the present war, there has been an ever-increasing amount of agitation from several responsible quarters, urging the Central Government to adopt a bold, vigorous, forward and enlightened policy for ensuring a carefully planned and enduring industrialisation of the country. For a second time in her industrial history, India has realised her helpless dependence on foreign imports for many of her essential needs and there has been an insistent demand on the part of the public and the press, that this opportunity should not be lost for mobilising the vast material resources and the potential scientific and technical talent for the industrial regeneration of the country.

At a recent meeting of the Industries Conference (December 1940) the Hon'ble Sir A. Ramaswami Mudaliar stated that the Government of India could give the commercial community an indication of the kind of industries which may safely be developed during the war and of the nature of assistance they could extend to such industries. This statement is re-assuring. There has been, however, a justifiable feeling that while the Government owing to stress of war, are concentrating their attention on war industries, other industries, which are essential for consolidating the industrial position of India have been either neglected or ignored. Taking into account the vast resources of the country, the urgency for rapid industrialisation and the exceptional opportunity offered by the war, the efforts of the Government, fall far short of public expectation. Addressing the All-India Manufacturers' Conference in Bombay (March 1, 1941) Sir M. Visvesvaraya, declared: "We must impress on the Government that they will not have discharged their duty to the

people of this country by encouraging only war industries which can be in production by the middle of 1942, but, that an endeavour is expected in this emergency on their part to make the country self-contained in as many requirements, both for peace and war, as posible." He pointed out that through lack of organisation, the country had practically stood still and allowed itself to be outstripped by many a foreign country within the last fifty years. "Our resources in men and material, if wisely utilised are colossal. A plan, leadership and an economic drive are the essential needs of the industrial situation to-day and these are lacking." Mr. Shah, Chairman of the Reception Committee of the same Conference, in the course of his welcome address, said that "the best use of the opportunity afforded by the war was not made, except in regard to the manufacture of munitions and other war materials under Government ægis. The fundamental objective of making a rapid stride in the pace of industrialisation was not being attended to with the vigour, enthusiasm and persistence, which the occasion demands." A similar view was expressed by Mr. G. L. Mehta, Vice-President of the Federation of Indian Chambers of Commerce and Industry, when he pointed out at a recent meeting of the Institution of Chemists (India) that the "authorities responsible for shaping the economic policies of our Government have been under the influence and domination of those interested in keeping their hold over the Indian market with the consequence, that the vital economic interests of India have been subordinated to those of the manufacturers and exporters in the United Kingdom". It will be superfluous to enumerate here the lacunæ in the industrial organisation of this country. The present offers a rare opportunity for filling them up. To take one instance, the establishment of heavy engineering and machine industries as a step for the manufacture of automobiles and the building of ships is urgently called for. The Government should take active steps for helping the establishment of these industries as a long-range proposition. The post-war period which followed the termination of the Great War, did not witness the materialisation of the great hopes which were raised at the time; on the other hand, the country's markets were flooded with foreign manufactures and the indigenous industrial effort was swamped out of existence. If the Government of India at the time, had only utilised the opportunity of making this country industrially strong and prosperous, the Empire, in its present crisis, would have had in India, a willing and mighty partner contributing substantially towards the war effort.

The Government of India have constituted the Board of Scientific and Industrial Research under the inspiring direction of Sir S. S. Bhatnagar; the Industrial Utilisation Committee has been brought into being as the logical sequence of the fruitful labours of the Board; several important lines of industrial research have been inaugurated; the resources of practically every laboratory in the country, have been utilised for the promotion of technical research. Indeed for the first time, there has been a belated, but nevertheless an earnest attempt on the part of the Government to recognise scientific research as a factor indispensable to the industrial economy of the nation.

During the short interval of less than a year and with the limited and meagre resources made available, the scientific workers in the country, have already justified the trust placed in them. The country

has provided ample demonstration, if any demonstration were needed, that industries can be successfully started in this country provided foreign competition is kept in check. At the moment the country is favoured with a condition of dwindling imports as a result of the European conflict. This is a condition which can be maintained even after the return of peace by the imposition of tariffs and legislating other forms of protection. These are well recognised and widely practised measures which are adopted by enlightened governments to effectively safeguard a peaceful and ordered development of their national industries.

The public and the industrialists of the country have a heavy responsibility in planning the industrial effort during the impending post-war period. Industrialists should collaborate with the scientific workers and finance researches which have a bearing on their industries. The financial support given by the Government of India is entirely inadequate considering the vastness of the field of research which confronts the country. The Government of India should increase its grant for industrial research and foresighted manufacturers should play their part in contributing towards research not only as a part of their long-term investment but as a social obligation. Mr. G. L. Mehta, in the course of his address referred to above, made the practical suggestion that a substantial portion of the revenues made available from the Excess Profits Tax might be usefully employed for the promotion of industrial research. Research Associations for specific industries composed of manufacturers' representatives and the research workers in the field should be started. This will pave the way for a closer and more fruitful contact between the scientists and industrialists and both will grow more and more appreciative of each other's point of view.

The Government of India have appointed the Post-war Industrial Reconstruction Committee, which is expected to consider problems of reconstruction in all its bearings. Industries that are now being developed as rapidly and extensively as possible, will no longer be actively engaged upon urgent war contracts; labour, now busy with these industries, will become redundant; there will be a surplus of stocks. In addition to these, the country will have to face keen competition from the industrially advanced nations whose productive efficiency, now harnessed for war industries, will be diverted towards peace-time manufactures. These problems will no doubt receive the careful and earnest attention of the Committee on which financial interests are adequately represented. The inclusion of the Director of Scientific and Industrial Research and the Director of the Indian Institute of Science, both of whom are actively engaged in directing Industrial research, will substantially facilitate the work of the Committee.

In the generous and wise words of Sir Fredirick Nicholson, the Government is "bound to consider Indian interests firstly, secondly and thirdly—I mean by 'firstly' that the local raw materials should be utilised, by 'secondly', that industries should be introduced, and by 'thirdly', that profits of such industries should remain in the country". To quote Pandit Malaviaji: "If measures for the industrial development of India are taken in this spirit, India will become prosperous and strong and England more prosperous and stronger."

CHROMOSOME NUMBER AND POLYPLOIDY IN AMPHIBIA

BY

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A VERY large amount of recent work has brought to light many important features in the chromosome cytology of Amphibia. Many of the early studies were confined to the chromosomes of the common Anura and Urodela and it is only recently that an extension of these studies has been made with reference to the other amphibians. Up till 1937 (Oguma and Makino) the chromosome numbers of one species of Apoda, 37 of Urodela and 30 of Anura were known. The chromosome number of one other species of Apoda has since been added (Seshachar, 1939).

From a study of the chromosome number in Amphibia it becomes clear that the variation in the chromosome number within the group obeys fixed laws. In Apoda, the number in only two species is known: $n = 21$ in *Ichthyophis glutinosus* and $n = 18$ in *Uræotyphlus narayani* (Seshachar, 1937; 1939). Among the Urodela the lowest number recorded is in *Proteus anguineus* (Stieve, 1920) where $n = 9$. In the majority of the Urodela belonging to the Amphiumidæ and Salamandridæ, the basal chromosome number shows an astonishing uniformity and might be taken to be the typical urodelan number. It is $n = 12$. In the Cryptobranchidæ and Hynobiidæ, however, there is a distinct departure. This variation is all the more striking because the difference between the basal urodelan number and that in the known examples of the above two families is very great. In fact, the latter is often more than twice the former. The numbers are as follows: $n = 20$ in *Hynobius retardatus* and varies from $n = 28$ in the majority of the species of *Hynobius* (*H. leechii, H. nigrescens, H. nebulosus, H. dunni*) to $n = 31$ in *Salamandrella keyserlingii*. In *Cryptobranchus allegheniensis* it is 31 and $n = 32$ in *Megalobatrachus japonicus*.

The variation is not so striking in Anura. *Bufo* appears to have $n = 11$ and in *Rana* n is generally 12. Many other species disclose this latter number (species of *Bombinator, Hyla*). The highest number observed in Anura is in *Alytes obstetricans* where $n = 16$ (Janssens & Willems, 1909).

From the foregoing account of the chromosome number in Amphibia certain conclusions can be drawn. The basal number in Amphibia appears to be $n = 12$. Wherever there are variations, in the majority of cases these variations may be traced to a fragmentation of the chromosomes resulting in a multiplication in the number. The work of the author has shown that the apparently diverse chromosome numbers in the two species of Apoda whose numbers are known, is deducible, according to Robertson's law, to the same basal number, which in this case is $n = 13$.

But the very large number of chromosomes found in examples of Cryptobranchidæ and Hynobiidæ cannot apparently be explained by Robertson's law and must have been brought about by a totally different kind of fragmentation from that which has resulted in the slight variations found in some species of Urodela, Anura and Apoda. The presence of a very large number of V-shaped chromosomes with atelomitic attachments precludes the application of this law. And apart from the fact that in these two families the basal number appears uniformly to be $n = 28$, nothing more can be said either about the origin or the significance of this change from the typical amphibian basal number of $n = 12$.

Vandel (1938) has, after a critical examination of the number of chromosomes in vertebrates, come to the conclusion that while in many vertebrates the basal number is $n = 12$, any increase (which is probably due to fragmentation) indicates a specialization and is correlated with the evolution of the group. He does not account for the enormous number of chromosomes found in Cryptobranchidæ and Hynobiidæ. While it is possible that these two families form exceptions to the rule, the origin of their chromosome numbers still remains to be

determined. And while fragmentation in general might indicate an evolutionary specialization within the group, the fragmentation in the case of these two families (if it is fragmentation) must have a totally different significance.

In this respect Anura is a more stable group. None of the species whose chromosomes are known exhibits the huge variations seen in Urodela and the slight changes in number noticed here have probably been brought about by fragmentation and indicate specialization. As already observed, the chromosomes of only two species of Apoda have been known and it is desirable that our knowledge of this group is wider before any definite conclusions are drawn. But it is significant that these two species, when Robertson's law is applied, reveal a basal number, $n = 13$.

Polyploidy.—Generally in animals, polyploidy is rare and whenever it occurs, it has not the same significance as in plants. Among Amphibia, triploids have been reported in *Rana esculenta* (Hertwig & Hertwig, 1920) and in the urodeles, *Triton palmatus* (Fankhauser, 1934) and *T. viridescens* (Fankhauser & Kaylor, 1935). Parthenogenetic triploid larvæ have been reported in *Rana pipiens* (Parmenter, 1933) and in *Rana nigromaculata* (Kawamura, 1939). Triploid and tetraploid larvæ have been found in *Eurycea bislineata* (Fankhauser, 1939).

Experimentally it is possible to induce polyploidy and of all the methods the most productive so far as the Amphibia are concerned, is the temperature factor; and Fankhauser and his colleagues have thrown much light on this problem in the urodeles.

It is a well-known fact that low temperatures applied during meiosis in plants result in a non-reduction of the chromosomes in the gametes which therefore retain the diploid number (Belling, 1925). The fusion of such diploid gametes with normal haploid gametes produces triploid zygotes. While low temperatures produce gametic duplication of the chromosomes, high temperatures produce somatic doubling.

Rostand (1936) first applied these methods to frogs and toads and was at once successful. In his hybridization experiments between frogs and toads, he exposed eggs immediately after insemination (with sperms of a different genus) to refrigeration and produced normal diploid gynogenetic tadpoles from these eggs. But it was found on cytological examination that the male chromosomes had not fused with those of the female and therefore the diploid nature was due to quite a different cause. It was discovered that the haploid chromosomes of the female had become doubled due to refrigeration. It probably had happened this way: in many Amphibia the nucleus of the egg is in the metaphase (Frog) or anaphase (Urodele) of the second division at the time of insemination and so, refrigeration immediately after, prevented the completion of this division. The result was, that the chromosomes of mitosis which should have gone into the second polar body came to be retained in the egg, which therefore became diploid. On the same analogy it is found that in newts (*Triturus*), triploid larvæ can be obtained only by refrigerating the eggs immediately after they are laid. Even if refrigeration is delayed by half an hour, normal diploid larvæ result. The explanation is that when the egg is laid, the nucleus is in the second division of meiosis, which is completed in about an hour's time after laying. An inhibition of this division which is the only method of making the egg diploid, can take place by refrigeration if applied quite soon after the eggs are laid (Griffiths, 1941).

Polyploidy in animals always leads to abnormalities and to death. In the urodeles studied, the animals lived up to metamorphosis and in no instance could complete it.

It is a well-known fact that among plants and also in many animals polyploidy leads to gigantism. In animals, Vandel (1927) reports it in the isopod, *Trichoniscus*, Seiler (1927) in *Solenobia* and Artom (1928) in *Artemia*. But in Urodela, no gigantism, either in triploid or pentaploid *Triturus* or in tetraploid *Eurycea* is seen. The gigantism in polyploid plants and animals is generally due to the fact that while the cell number in organs remains the same, the cell size becomes very much larger. In polyploid newts on the other hand, the cell size is larger, but the cell number in each organ is reduced with the result that the size of the

polyploid animal remains almost the same as that of the diploid one. Similar instances of polyploid plants, where in spite of larger size of the cells, the plant size on the whole remains normal is reported by Hagerup (1932) in *Euphorbia granulata*. Fankhauser (1941) recently found a single pentaploid *Triturus viridescens* whose body size was not different from that of the normal diploid individual of the same age, though the cell size was very much larger than the normal. This points to the conclusion that in newts there is some regulatory mechanism which comes into play in polyploid individuals and which reduces the cell number in the organs to offset the increase in cell size.

The cytology of the effect of abnormal temperatures in producing polyploidy can only be conjectured at this stage. It is clear that of the two structures of the cell in meiosis,—the chromosomes and the spindle,—temperature has its effect only on the spindle and not on the chromosomes, for the latter are seen to behave normally and to divide, but their separation into two distinct daughter nuclei is prevented. This is probably due to some disturbances in the spindle mechanism brought about by change of temperature.

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CANCER RESEARCH IN INDIA

THE TATA MEMORIAL HOSPITAL which His Excellency Sir Roger Lumley, Governor of Bombay, opened on 30th April 1941, is one of the benefactions which India owes to the illustrious Tata family. This splendidly equipped institution dedicated to the treatment of Cancer will serve not only the purpose of a hospital, but also that of an advanced centre of research for the study of this malignant disease.

In a special supplement to the *Times of India*, dated 1st March 1941, Dr. V. R. Khanolkar, Director of the Cancer Research Laboratory, writes: "The establishment of a hospital devoted to cancer research in Bombay on the lines of the Memorial Hospital in New York, is a departure which takes into account the shortcomings of purely experimental institutions in other parts of the world. Just now when a large part of the world is involved in a life and death struggle and the best energies of the human race are directed towards destructive activities, it is an important achievement to have started a humanitarian institution for the better care of people suffering from malignant diseases.

"The Tata Memorial Hospital is particularly fortunate, inasmuch as the Trustees have been farsighted enough to organise a place where besides study, treatment and laboratory research would be intimately coordinated and the clinician will be a research worker, and a laboratory investigator will have an opportunity of extending the experience gained from the laboratory to the hospital patient.

"The institution is unique in its conception inasmuch as most of the clinicians and the whole of the laboratory staff will be devoting their whole time to the work at the institution."

ON THE HEAT-WAVE OVER NORTHERN INDIA IN APRIL-MAY, 1941

BY

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THE outstanding feature of Indian weather in the second half of April and the first week of May of this year was the extremely high temperatures over a large part of Northern India. For nearly a fortnight during this period, the temperatures were generally 8° to 15° F. above normal in the North-West Frontier Province and the whole of the Punjab, while in the west United Provinces, east Central India, the northeast Central Provinces and the adjoining districts of the east United Provinces they were 6° to 10° F. above normal continuously for more than three weeks. On account of the heat-wave, a number of deaths due to sun-stroke are reported to have occurred in the Punjab and the United Provinces.

High temperatures were first recorded in the region extending from the Punjab to the northeast Central Provinces on the 8th April in the front of a western disturbance. With the eastward movement of the disturbance, the temperatures decreased slightly, but still remained above normal in the west United Provinces, east Central India and the northeast Central Provinces. Thereafter, the temperatures gradually rose in the North-West Frontier Province also and became above normal on the 13th. The high temperatures then extended eastwards and southwards into the Punjab, upper Sind, the United Provinces and Central India. The heat-wave was at its maximum on the 4th May when most of the stations in the Punjab and a number of stations in the United Provinces recorded 115° F. and above. The spell of high temperatures continued till the 7th or 8th and was finally broken by two active western disturbances which took a fairly southerly course and produced extensive dust and thunderstorms in the Punjab and the United Provinces between the 9th and 13th.

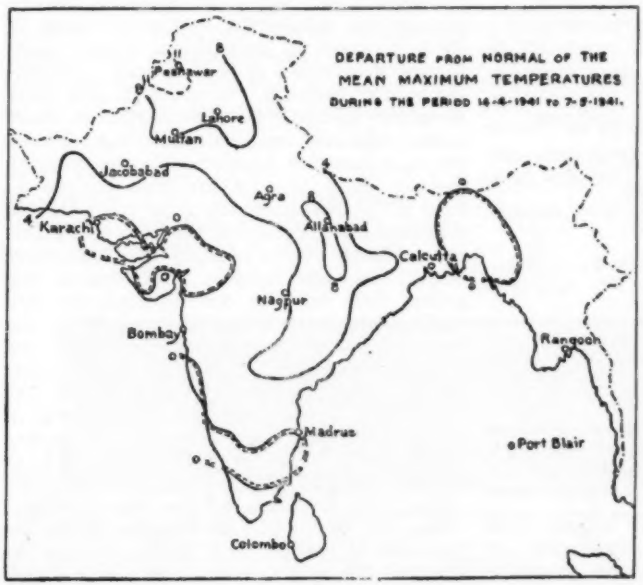

FIG. 1

The departures from normal of the mean maximum temperatures during the period 14th April to the 7th May and of the actual maximum temperatures on the 4th May are shown in Figs. 1 and 2 respectively.

The following table gives the highest temperatures recorded this year in April and those ever recorded in the same month in previous years. It will be seen that the maximum temperatures this year in April broke all previous records for the month in the North-West Frontier Province, while, in the southwest Punjab, they touched the highest temperatures so far recorded.

It is interesting to note that the high temperatures produced a "heat low" over the Punjab with a pressure

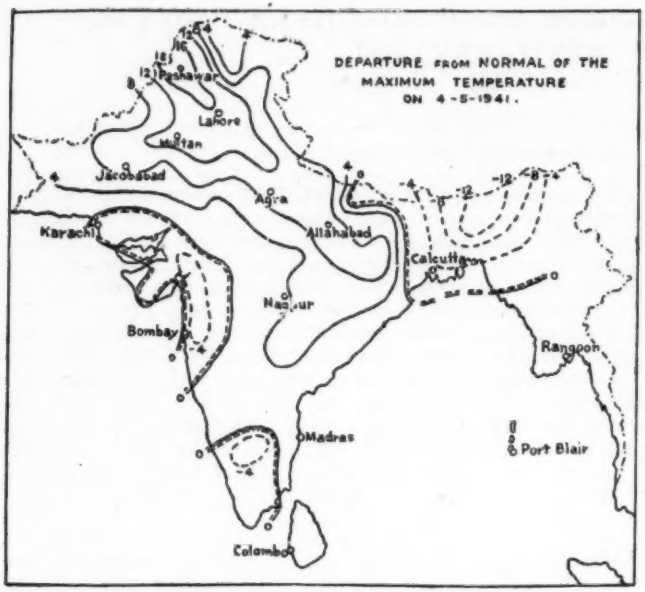

FIG. 2

TABLE I

Province	Highest temperature recorded in April this year	Highest temperature ever recorded in April in the past
North-West Frontier Province	116° F. at Dera Ismail Khan on the 28th	113° F. at Dera Ismail Khan on the 18th April 1892
Punjab Southwest	116° F. at Leiah and Multan on the 27th and 28th and at Khushab on the 28th	116° F. at Khushab on the 22nd April 1892
Punjab, East and North	115° F. at Ludhiana on the 27th and 28th and at Lahore on the 28th	117° F. at Sirsa on the 18th April 1892
United Provinces, West	113° F. at Agra on the 27th and 28th	114° F. at Jhansi on the 28th April 1914.
United Provinces, East	113° F. at Cawnpore on the 27th	114° F. at Allahabad on the 28th April 1879

deficiency of nearly one-third of an inch of mercury, when the heat-wave was at its peak. Had such a defect in pressure been associated with a western disturbance, there might have been a deluge in the Punjab!

Another noteworthy feature in the history of this heat-wave was that although, as many as seven westen disturbances affected the country from the middle of April to the end of the first week of May, none of them produced appreciable precipitation in the North-West Frontier Province, the Punjab and the United Provinces. All of them were feeble and took a more northerly course than usual. Thus the above Provinces were deprived of the cooling caused by dust or thunderstorm or by the movement of the cold fronts of western disturbances. This would account for the persistence of the high temperatures for such a long period.

It is generally recognised by medical men that the discomfort to the human body during heat-waves depends considerably upon the wet bulb temperature of the air: the higher the wet bulb temperature, the greater the discomfort. A temperature of 80° F. is taken to indicate the danger point for the occurrence of heat strokes. According to Dr. Haldane, "if the wet bulb temperature exceeds 78° F., continuous hard work becomes impracticable and beyond 88° F., it becomes impracticable for ordinary persons even to stay for long periods in such air". An examination of the wet bulb temperatures recorded at the various stations in northwest India during the heat-wave under discussion shows that during the period 29th April to the 5th May, the wet bulb readings at 8 hours at many of the stations in the United Provinces and the Punjab exceeded 75° F., while at some stations they touched 80° F. and above. The temperatures must have been still higher at the time of the maximum in the afternoon. Some of the noteworthy wet bulb readings actually recorded at 8 hours during the heat-wave were Lucknow 81° on the 2nd May, Hissar 84° on the 3rd, Fort Abbas 80° on the 2nd and 85° on the 3rd, Multan 81° on the 4th and 5th and Jacobabad 86° on the 2nd. These high temperatures must have contributed in no small measure to the sun-strokes reported during the heat-wave.

LETTERS TO THE EDITOR

FUSE SPECTRUM OF ALUMINIUM

PREVIOUS investigators[1] on the fuse spectra of elements have studied the reversals, the shifts and the intensities in the spectral lines emitted by wires which are exploded either by a high voltage supply or by discharge of a charged condenser through them. With a view of comparing the relative intensities of lines in the direct current fuse spectrum and in the low current arc spectrum, a study of the spectra of silver, copper and aluminium was undertaken. In the fuse spectrum of aluminium obtained in air, however, a continuous spectrum has been observed in the background and the sharp series lines are all found reversed against it. Vaudet and Servant,[2] who exploded aluminium wire in vacuum by discharge of a 0·64μF condenser charged to 50 Kv., report the entire absence of a continuous background. In the present investigation, the wire was exploded by joining it directly across a 120 volt D.C. supply. Fig. 1 (A) is a reproduction of the spectrum in the region λ2300–2100 Å, and the continuous spectrum is observed to extend beyond 2100 Å; the accompanying low current arc spectrum (B) reveals the absence of any continuous spectrum. The emission of the continuum in the fuse spectrum of aluminium has given rise to the appearance of the sharp series lines

$$3\,^2P_{\frac{1}{2},\frac{3}{2}} - n\,^2S_{\frac{1}{2}}$$

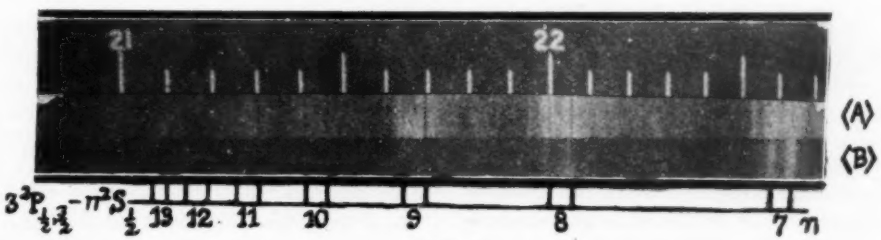

FIG. 1

in absorption. Those who have studied the arc spectrum of aluminium earlier have observed these lines only upto $n = 8$, as the arc spectrum reproduced in Fig. 1 (B) indicates. When the aluminium wire explodes due to a passage of current of the order of 60 amps., instantaneously an atmosphere of aluminium vapour surrounds the discharge. As a consequence the emission lines of the sharp series are all reversed by absorption in aluminium vapour. Even in the fuse spectrum a closer examination reveals that only the lines upto $n = 8$ or 9 are emitted and then reversed; but higher members of this series extending upto $n = 14$ are seen reversed against the continuum. As in the arc spectrum, the higher members are probably not radiated, but the aluminium vapour exercises a selective absorption on the continuous spectrum. The strengthening of the continuum in this region may partly arise from the widening out of the lines of the diffuse series.

In conclusion I desire to thank Dr. L. Sibaiya for his kind guidance.

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May 12, 1941.

[1] Anderson, *Astrophys. Jour.*, 1920, **51**, 37; Anderson and Smith, *Ibid.*, 1926, **64**, 295; Menzies, *Proc. Roy. Soc.*, 1928, **117**, 88; Futagami, *Inst. Chem. Research, Tokyo, Sci. Papers*, 1937, **671**, 1.

[2] Vaudet and Servant, *Comptes Rendus*, 1935, **201**, 195.

ON THE STABILITY OF VITAMINISED OIL

IN the second Addendum to *British Pharmacopœia*, 1932, it has been suggested that a vitamin A and D concentrate may be dissolved in a suitable vegetable oil to obtain the *Oleum vitaminatum*, B.P. But as vegetable oils gradually develop rancidity through the formation of peroxides which are found to be responsible for the destruction of Vitamin A in Cod and Halibut liver oils,[1] it was considered to be of interest to have a knowledge on the vitamin A destruction in the type of a vitaminised oil as suggested in the B.P. Addendum.

Accordingly, an investigation has been undertaken to compare the oxidative changes and subsequent fall of vitamin A potency when stored under customary conditions. With a view to ascertain the relative keeping properties, dried and carbon dioxide-free air was passed for more than 96 hours at the room temperature (28° C.) through cod liver oil containing about 800 I.U. of vitamin A per gm., and through an oleum vitaminatum B.P. made from arachis as well as olive oil. The vitamin A content was determined by the well-known Car-Price method, using a Lovibond tintometer.[2] The peroxide values were determined by the method, first suggested by Nakamura[3] and subsequently modified by Basu and Mazumdar.[4] The graph (Fig. 1) shows the relative stability

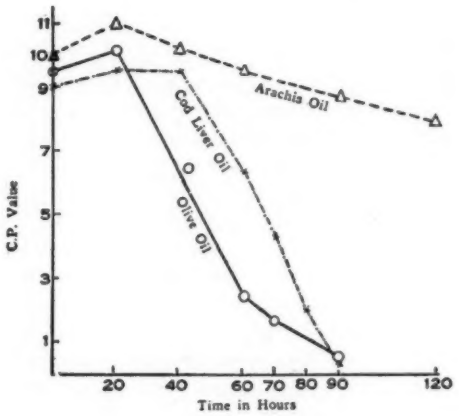

FIG. 1

of vitamin A in the three products studied so far. More than half the vitamin A potency is being retained in the vitaminised oil made with arachis oil even when air was passed through more than 160 hours; whereas almost complete destruction took place in cod liver oil within 90 hours.

To show further that the stability of vitamin A in arachis oil may be further increased by the addition of suitable anti-oxidants, the

vitaminised oil prepared with arachis oil was mixed with hydroquinine (0·2 per cent.)[5] and the oil aerated. The figures in Table I tend to indicate that though there is a slight fall of potency (10 per cent.) during the first period of 120 hours, the vitamin A value was found to remain practically constant when aeration is continued for the next 300 hours.

TABLE I

Stability of vitaminised arachis oil incorporated with 0·2% hydroquinone

Air passed for hours	Blue value	Peroxide value
0	10	0·8
60	9·4	1·0
120	9·0	1·15
180	9·0	1·5
300	8·95	1·55

Work is also in progress to show how far the oxidative changes, *i.e.*, the formations of peroxides, aldehydes and free acids in various oils are responsible for the destruction of vitamin A in such type of oleum vitaminatum B.P. and whether the destruction of vitamin A is solely dependent on the formation of peroxides in the fats.[6]

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Baranagore, Calcutta,
March 25, 1941.

[1] Whipple, *Oil and Soap*, 1936, **13**, 231.
Lowen *et al.*, *Ind. Eng. Chem.*, 1937, **29**, 151.
[2] Coward *et al.*, *Biochem. Jour.*, 1931, **25**, 1102.
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[3] Nakamura, *Jour. Soc. Chem. Ind. Japan*, 1937, **40**, 206 B.
[4] Basu and Mazumdar, *Leprosy in India*, 1939, **2**, 54.
[5] Jones and Christiansen, *Jour. Amer. Pharm. Assoc.*, 1935, **24**, 465.
[6] Smith, *Biochem. Jour.*, 1939, **33**, 201.

CATALASE ACTIVITY IN *MANGIFERA INDICA*

THE natural drift of such enzymes as catalase, oxidase and peroxidase in the life of the fruit from fruit-setting to ripening in case of *Mangifera indica* clearly showed a close correlation with the distinct metabolic phases of the fruit.[1] The catalase activity was shown in distinct well-marked phases, *viz.*, (1) an early phase of very low activity, (2) a phase of rapid and steady increase, (3) a period of higher level activity with (4) steep rise to maximum activity, and (5) rapid decline to a minimum.

It will be seen from the table that the maximum catalase and peroxidase activities, corresponded with the mature stage of the fruit and the consequent climacteric and the higher respiratory efficiency of the fruit.

A positive correlation of the catalase and peroxidase activity of the fruit with hæmin Fe content of the tissue at that stage, can also be observed from the table.

TABLE I

Age in days from fruit-setting	Average fresh weight in gm.	Catalase mg. O_2 per gm. pulp	Peroxidase mg. glucose oxidised per gm. pulp	Hæmin Fe mg. per gm pulp	Vitamin C mg. per gm. pulp
13	1	0·12	0·07	·016	..
42	5	0·15	0·08	·021	2·6
57	15	0·20	0·11	·036	..
72	60	0·88	0·12	·125	..
82	65	2·00	0·20	·149	1·7
84	99	3·75	0·25	..	..
99*	150	4·2	0·30	·158	..
106	150	13·5	0·35	·151	0·86
112	..	52·0	0·65	..	..
114	150	64·7	0·80	·272	..
115	..	78·4	0·85	·278	..

* At this stage ripening begins.

The enhanced catalase activity under artificial doses of ethylene[2,3] as compared to cold storage and storage under room conditions is recorded in Table II.

TABLE II

Showing catalase activity (mgO_2/gm. pulp) in storage and ethylene treatment on mature fruits of 99 days age

Days in storage	Cold storage 8°–12° C.	Ethylene treatment 28°–32° C.	Room condition 28°–32° C.
Initial conc.	4·1	4·1	4·1
7	4·9	15·0	8·25
14	4·8	16·2	9·50
21	4·9	11·8	9·50

Further studies are being carried out on cystin, cystein, glutathione and ascorbic acid drift in relation to flowering and alternate bearing in mangoes. Detailed results will be published elsewhere.

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Calcutta,
February 24, 1941.

[1] Kar, B. K., and Banerjee, H. K., *Nature*, 1939, **144**, 597.

[2] Bagster, L. S., *Chem. Abs.*, 1940, **34**, 4174.

[3] Kar, B. K., and Banerjee, H. K., *Curr. Sci.*, 1940, **9**, 321.

THE OCCURRENCE OF *DARLUCA FILUM* (BIV.) CAST. ON CEREAL RUSTS IN SOUTH INDIA

A NUMBER of fungi are known to parasitize the uredo sori of several rusts. Of these *Darluca filum* has been observed in several parts of the world and on different genera of rusts. Saccardo[1] has mentioned that it occurs in different parts of Europe, America, Ceylon and Africa. Solunskaya[2] has observed *D. filum* in the Ukraine parasitizing *Uromyces betæ* but it occurs too late in the development of the disease to cause any appreciable reduction of rust. Van Poeteren[3] noticed that the virulence of willow rust (*Melampsora* sp.) in Holland was considerably reduced by this fungus. Nicolas[4] mentions that the uredo sori of *Puccinia glumarum* are affected by this fungus in France. Canonaco[5] has reported the occurrence of the fungus on the uredo sori of Uredineæ of various Gramineæ in Eritrea. Fedorintchik[6] has made a detailed study of the fungus in the U.S.S.R. and states that it is parasitic only on the rusts, feeding on the spores and intercellular mycelium and not on the host. He has described a method of utilising the fungus for the control of rust. Artificial infections were successful on *Puccinia dispersa, P. simplex, P. graminis* and *P. coronifera*. It has also been noted on *Puccinia asparagi* in England.[7] From India the only record is by Butler[8] on uredinea of *Puccinia polygonia amphibii* on *Polygonum* sp. from Mussoorie.

During the last few years when specimens of *Sorghum vulgare, Pennisetum typhoides* and *Setaria italica* affected by *Puccinia purpurea, P. penniseti* and *Uromyces setaria-italicæ* respectively were collected for teaching purposes in the months of November–January, it was found that in many instances the uredo sori were parasitized by *Darluca filum*. Dark brown or almost black pycnidia were observed in large numbers protruding out from below the ruptured epidermis giving a black colour to the sori. In such sori the uredo spores were few and shrivelled.

The pycnidia are dark brown, ostiolate, nearly round or oval with a small neck in some cases. They measure on an average $81·3 \times 96·5\ \mu$ (Figs. 1 and 2). The spores are hyaline, two

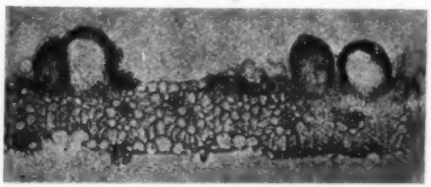

FIG. 1

Section of leaf of *Setaria italica* with *D. filum* on *Uromyces setaria italicæ* (× 200)

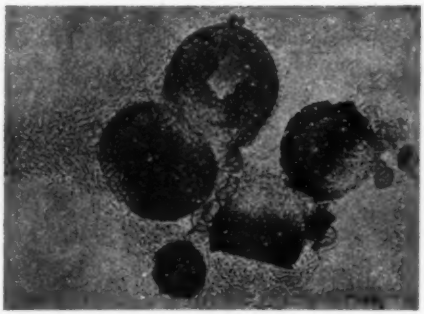

FIG. 2
Pycnidia and spores of *D. filum* (× 500)

celled with a slight constriction in the middle where the septum is present. They measure on an average $15{\cdot}4 \times 4{\cdot}1\,\mu$, the range being $12{\cdot}9 - 17{\cdot}2 \times 2{\cdot}2 - 6{\cdot}5\,\mu$.

D. filum develops usually only in the later stages of the rust infection especially during and after rainy weather. The first formed rust sori are free from infection but later in the season most of the uredo sori are affected. Though the fungus may cause damage to a large number of uredospores its usefulness in the effective control of these rusts is doubtful. As Solunskaya has stated in the case of *Uromyces betæ* the fungus comes on the scene after a lot of damage has been caused to the host plant. *D. filum* has not previously been recorded on cereal rusts in India.

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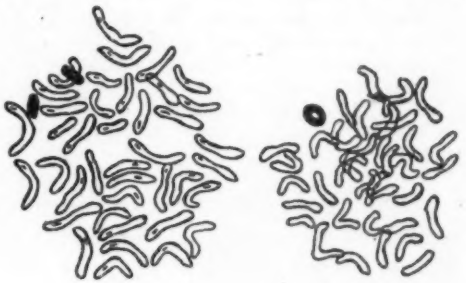
CERTAIN ABNORMALITIES IN THE ROOT TIP OF GROUNDNUT

IN a previous communication,[1] the occurrence of chromatin bridges in the root tip of groundnut (*Arachis*) was recorded. Certain other abnormalities noted since are given in this note.

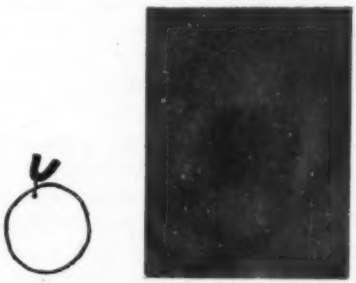
Fig. 1 shows a metaphase plate in the root tip cell of "Pollachi red", a variety of *Arachis hypogœa*. In it there are forty chromosomes and two fragments (the latter alone being shaded dark). The $2n$ number of this variety is forty. Fragmentation of chromosomes has been reported in other genera, *e.g.*, *Allium*.[2]

In Fig. 2, a metaphase plate in another variety of *Arachis hypogœa* (A.H. 73—"Native Tanganyika") is shown wherein a chromosome-ring



1 2

has been formed. Ring-chromosomes have been reported in a few genera like *Zea*,[3] *Gossypium*,[4] etc. An instance of lateral satellite was also met with in this variety at prophase (Fig. 3), which appears to have been caused by probable



3 4

inversion of the satellited chromosomes. Lateral trabants have been reported to occur as a

[1] *Syllege Fungorum*, 1884, **3**, 410.
[2] *Rev. App. Myc.*, 1932, **11**, 91.
[3] *Ibid.*, 1936, **15**, 74.
[4] *Ibid.*, 1936, **15**, 488.
[5] *Ibid.*, 1937, **16**, 279.
[6] *Ibid.*, 1939, **18**, 580.
[7] *Ibid.*, 1939, **18**, 778.
[8] *Sci. Mem., I.C.A.R.*, 1931, No. 1, 154.

result of spontaneous structural changes in *Crepis*,[5] and due to X-raying in *Aloe* and *Vicia*.[6]

Another abnormality, *viz.*, somatic doubling, which has been reported in many other genera to occur either spontaneously or as a result of chemical and other treatments, was noticed in A.H. 42 ("Bunch Mozambique"), another type of *A. hypogœa*. The doubled chromosomes shown in Fig. 4 exhibit 'somatic pairing' to a striking extent due to parental homology.

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May 14, 1941.

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[2] Levan, A., *Hereditas*, 1932, **16**, 257.
[3] McClintock, B., *Proc. Nat. Acad. Sci.*, 1932, **18**, 677.
[4] Jacob, K. T., *Curr. Sci.*, 1941, **10**, 174.
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[6] Camara, A., *Bull. Soc. Ital. Biol. Sperim*, 1939, **17**, 46.

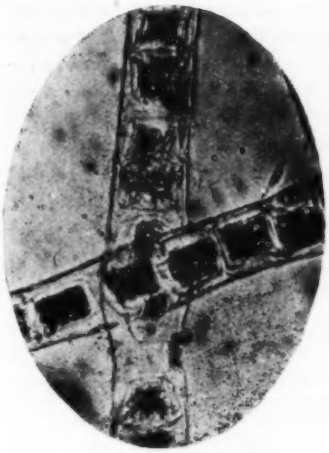
GENUS *CYLINDROCAPSA* IN INDIA

SPECIES of *Cylindrocapsa* are by no means rare in India. During the collections of algæ from the Punjab and the United Provinces from 1929 to 1941, the writer came across three species. Of these, the commonest is *C. œdogonioides*,[1] with vegetative cells 18μ to 20μ broad and 12μ to 28μ long, which was collected in a fertile condition from a tank at Dasuya in the Punjab, and in sterile condition from many 'jheels' and sluggish freshwater streams in Fyzabad and Gonda districts of Oudh in the months of January, February and March. In sterile condition this alga resembles *C. geminella* Wolle in cell dimensions. The second species with cells intermediate in size between *C. œdogonioides* and *C. scytonemoides* was collected from the surface of stones mixed with a diminutive species of *Stigeoclonium* and numerous Myxophyceæ from Kosi, a torrential stream near Almora in September, 1939. The third species is *C. scytonemoides*,[2] which has the broadest cells (24 to 30μ) among all the species. This alga also shows a peculiar mode of vegetative propagation and was collected by the present author from a freshwater drainage channel near village Mamrezpore in Fyzabad district.

A very interesting note was communicated by Iyengar[3] on the life-history of a *Cylindrocapsa* collected by him from Madras, which he provisionally described as *C. gemminella* Wolle. In a foot-note this author observes, "The Alga in its life-history differs in several aspects from *C. involuta* and also from *C. geminella*". Though dimensions of the cells and filaments of the Madras species of *Cylindrocapsa* were not given by Iyengar in the preliminary note but from his photo-micrographs, the present author saw a number of resemblances between the Madras *Cylindrocapsa* and the Fyzabad *Cylindrocapsa* which he had described as *C. scytonemoides*. Prof. Iyengar very kindly sent me a sample of his specimen which was closely examined and compared with the Fyzabad specimen. This has convinced the present author that the Madras specimen is identical with *C. scytonemoides*.

The samples collected from Fyzabad were all in a purely vegetative condition, loaded with starch particles which obscured the structure of the chloroplasts described as a massive parietal bodies as in other species of *Cylindrocapsa*. Describing the chloroplasts of his specimen, Iyengar[3] observed, "A careful examination of the living material shows very clearly that the chloroplast is definitely stellate". On careful examination of the same material by me the cells were observed in an active state of cell-division and the chloroplasts were stellate only in younger cells. In mature cells they were of the usual parietal type (Fig. 1). The stellate shape in younger cells results from the in-growth of mucilaginous lamellæ. However, the normal type of chloroplast in this alga may be safely described as *parietal and not stellate*.

Re-examination of Prof. Iyengar's material further revealed the presence of the peculiar mode of vegetative propagation described by the present author[2] from the Fyzabad material. Unlike other filamentous green algæ, species of



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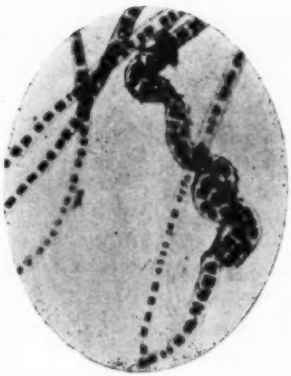

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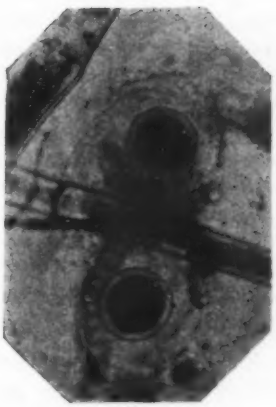

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Cylindrocapsa scytonemoides Randhawa

(Figs. 1–3)

Fig. 1.—Showing stellate and massive parietal chloroplasts in the same material.

Figs. 2 & 3.—Stages in vegetative reproduction.

Note.—Photomicrographs 1–3 of Prof. Iyengar's material from Madras.

Cylindrocapsa œdogonioides Randhawa

(Figs. 4 and 5)

Fig. 4.—A filament showing cells with chloroplasts and empty cells from which motile contents have escaped.

Fig. 5.—Showing two detached oogonia.

Cylindrocapsa are more primitive in their organisation and the individual cells retain the power of independent growth and development not only in a straight linear direction, but also laterally so that the filaments become bi-seriate at places (Fig. 2). This behaviour results in the production of hormogone-like filaments which remain glued together for some time and ultimately dissociate (Fig. 3).

In *C. œdogonioides* usually cogonia develop by the enlargement of ordinary vegetative cells, singly or in pairs as in species of *Œdogonium*. On reading Iyengar's account of the life-history of *C. geminella* Wolle (= *C. scytonemoides*), which strikes at once as very unusual and unique among algæ, the present author re-examined his material. On certain filaments of *Œdogonium*, found mixed with *C. œdogonioides*, he discovered certain *detached oogonia* also, similar to those figured by Iyengar, but with ripe thick-walled oospores (Fig. 5). Though such detached oogonia were seen before also, but their significance was missed and their detached position was thought to be due to accidental dissociation from some filaments. These detached oogonia seem to point out that in *C. œdogonioides* also quadriciliate female macro-zoospores are produced, which after a period of swarming, settle down, secrete a cell-wall which becomes the loose sheath of the oogonium, while protoplasmic contents round off and produce an oosphere. It is likely that even the oospheres in the oogonia found in the filaments have also an abbreviated, flagellate-free-swimming phase.

The life-cycle of *C. scytonemoides* as observed by Iyengar is unique among green algæ. A certain parallelism is seen between the dwarf males of *Œdogonium* and those of *C. scytonemoides*; but there is no structure in *Œdogonium* comparable with the detached oogonia of the latter, which Iyengar calls dwarf female plants.

The quadriciliate macro-zoospores of *C. scytonemoides* with female potentialities show certain resemblances with quadriciliate macro- and micro-zoospores of *Ulothrix*. While in *Ulothrix* the macro- and micro-zoospores serve the purpose of vegetative multiplication only and sexual fusion is seen only among isogamous biciliate gametes, in the case of *C. scytonemoides* sexuality is evolved in the macro- and micro-zoospores as well, the former producing a non-motile oosphere or macro-gamete and the latter producing two to four micro-gametes or antherozoida.

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Collector's House,
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June 3, 1941.

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[2] —, *Hedwigia*, Dresden, 1939, **78**.
[3] Iyengar, M. O. P., *Curr. Sci.*, 1934, **8**.

OBSERVATIONS ON *BALANTIDIUM COLI* (MALMSTEN)

Extensive work has been done in different parts of the world on *Balantidium coli* (Malm.) which has been reported from the intestine of pigs, monkeys and man. We had the opportunity of examining the gut contents of the gibbon, *Hylobates hoolock* (Harlan) which died in the Zoological Gardens, Calcutta. We found it heavily infected with *B. coli*. A remark on its morphology together with the boring apparatus is described here.

The ciliate in this host measures 40–70μ in length and 35–50μ in breadth. They are more or less ovoid in shape with the anterior extremity narrower than the posterior. The macronucleus varies from 14–26μ in size and is either straight or in the form of a horse-shoe shape, while the micronucleus, which varies from 3–5μ in diameter, is subspherical in shape and lies in a notch near the middle region of the macronucleus. In the majority of the specimens there are two contractile vacuoles, one situated at the posterior end and the other near the middle of the body close to the macronucleus.

In the region of the peristome in *B. coli* and *B. suis* existence of a definite system of intracytoplasmic fibres termed as 'neuromotor apparatus' was shown by McDonald.[1] It included a J-shaped motorium in the ectoplasm close to the œsophagus in addition to the fibres, which

are directly or indirectly connected with it. McDonald[1] considers that the thickened ectoplasm and the movement of the cilia of the peristomial region are correlated with their feeding and also with their ability to penetrate into the mucosa of the intestine. He points out that the pellicle and the ectoplasm of the

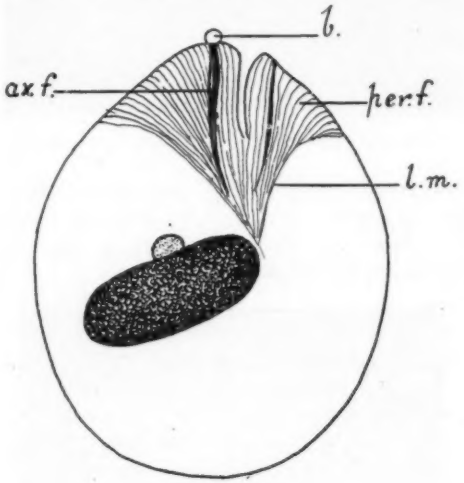

FIG. 1

B. coli from *H. hoolock*. × 1666. *ax. f.*–axial system of fibres; *b.*–borer; *l.m.*–limiting membrane; *per. f.*–peripheral system of fibres.

anterior region of the ciliates are thicker than any other part of the body and the cilia of this region beat spirally producing a boring action. Ray[2] also observed in *B. sushilii* in the region of the peristome, a system of fibres, which he described under two heads: the axial and the peripheral system of fibres. According to him the former, together with a knob-like structure at its anterior end, called the borer, constitutes the boring apparatus, since by means of this the parasites bore their way into the intestinal epithelium.

This same boring apparatus was also found by one of us (Chakravarty[3,4]) in *B. elongatum*, *B. helenæ*, *B. rotundum*, and *B. depressum*. We have examined the condition of the apparatus in the ciliate under report and give below the description of its component fibres and its bearing on the boring mechanism.

A group of fibres (*per f*), which corresponds to the longitudinal and peripheral fibres of McDonald[1] and Ray[2] respectively, is seen in this species on both the sides of the peristome arranged more or less obliquely. These fibres converge mesially towards the centre of the longitudinal axis of the body so as to form a sort of limiting membrane (*l.m.*) and in no case they pass beyond the centre of the body length. Schneider,[5] Ten Kate[6] and Ray[2] hold that these fibres have a supporting function lending rigidity to the body. We could not find here the J-shaped motorium described by McDonald in this species as well as in *B. suis*.

Besides the peripheral fibres there are two or three fibres on the left-hand side of the peristome comparable to the axial system of fibres of Ray.[2] The fibres arise from the base of a knob-like structure termed 'borer' by Ray[2] and pass posteriorly to meet the limiting membrane. They are spirally wound together forming a stout cord. The borer is situated just outside the pellicle but can be partially retracted within a notch in the pellicle. We also find a few fibres attached beneath the pellicle similar to those found by Chakravarty[4] in *B. depressum*. These should also be included under the axial system of fibres.

Since we fail to find any neuromotor apparatus as reported by McDonald[1] and the ciliates actually bore through the epithelium of the intestine we are in favour of regarding the knob and the associated fibres both of peripheral and axial system as forming together the boring apparatus.

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Calcutta,
May 2, 1941.

[1] McDonald, J. D., *Univ. Calif. Public. in Zool.*, 1922, **20**, N. 10.
[2] Ray, H. N., *Jour. Roy. Micros. Soc.*, 1932, **52**.
[3] Chakravarti, M., *Curr. Sci.*, 1933, **1**, No. 2.
[4] —, *Arch. Protistenkde*, 1936, **87**.
[5] Schneider, K. C., *Arb. a. d. Zool. Inst. d. Univ Wien u. d. Zool. Stat. Triest*, 1906, **16**.
[6] Ten Kate, C. G. B., *Arch. Protistenkde*, 1927 **57**.

EMASCULATION IN CHILLIES (*CAPSICUM* GENUS)

EMASCULATION, the first and the most important operation, to be attended to during the process of hybridization entails a good deal of care and precaution on the part of a plant-breeder. More often it is done by completely removing the stamens, one by one, by forceps or by a pair of scissors, before the anthers begin to burst and just at the time the flower begins to open. This method of removing the anthers takes some time and often, in spite of the several precautions taken, there may be a likelihood of one or more stamens being left in the flower, specially in those where a large number of stamens have to be removed.

In chillies the stamens are all epipetalous, and the corolla is so brittle that the tubular corolla can easily be removed without any injury being caused either to the ovary, the style or the stigma. When the fully matured bud, which is expected to open the next day, is split at the corolla to remove the anthers one by one, it was found that in some cases the tubular corolla, being brittle fell off easily, leaving intact the gynæcium. This led us to try if the epipetalous corolla tube (Fig. 2) cannot be removed wholesale instead of attempting to remove the stamens one by one.

The pedicel of the flower is held, in between the thumb and the fore-finger of the left hand, with a careful and firm grip of the calyx enclosing the ovary, and with the right-hand thumb and forefinger the tubular corolla is cautiously removed without applying much pressure lest any damage should be done to the style and the stigma (Fig. 1). It is quite gratifying to note that this method of emasculation gave as much percentage of setting as the other (removal of anthers by forceps, etc.) with the one great advantage of saving good amount of time.

Detailed data regarding the number of flowers that could be operated in a fixed time by both the methods and the percentages of setting is being collected. At any rate, that

FIG. 1

the process of removing epipetalous corolla tube is found to be much quicker and easier than removing the stamens one by one, is established beyond doubt.

FIG. 2

It may not be out of place to mention here, that even illiterate coolies, specially women with delicate hands, were able to do this operation with the greatest amount of confidence and success giving a very good percentage of setting. Preliminary trials are being conducted with tobacco flowers also where the results are quite encouraging and the same may be found suitable for most other epipetalous flowers.

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April 16, 1941.

VEGETATIVE PROPAGATION OF MANGO FROM GOOTES (MARCOTTE) AND CUTTINGS BY TREATMENT WITH HIGH CONCENTRATION AUXIN

In a previous communication[1] the result of the preliminary experiment on the root formation in mango gootes, by application of 1 per cent. indole acetic acid, was reported. The experiment was further continued and it has been possible to successfully raise plants, by the above method, from 80 per cent. of the gootes taken from young plants of two and three years old.

Experiments were also undertaken to propagate plants from cuttings of mango and it has been possible to do so from cuttings of two- and three-year old plants by treatment with 3 per cent. indole acetic acid. In the present experiment the ring of bark from the twig, from which the cutting was to be made, was removed and treated with lanoline sclution of auxin, quite similarly as the gootes were treated. After twenty-four hours of such treatment the twig was severed from the mother plant at the lower end of the ring and planted in soil in a slanting position. Photograph of one such cutting taken cut of the soil, after seven months of treatment, is given in Fig. 1, to show the induced root formation. There was no root formation in the untreated ones which died after a certain time. One per cent. indole acetic acid induced slight root formation in some of the cuttings, whereas, 1 per cent. and 3 per cent. naphthalene acetic acid were ineffective in producing roots.

When the mother plants were aged, propagation by the above methods was not successful. Though Auxin treatment induced root formation in the gootes of such plants, the time taken for root formation was comparatively much longer and the number of roots produced much fewer, being quite insufficient for the independent existence of the goote in the soil. In the cuttings of the aged tree auxin treatment induced no root formation.

It has been concluded that the age of the mother plant has some influence on the root formation in gootes and cuttings of mango by treatment with auxin. Further attempts will, however, be made to investigate means of overcoming the difficulty of such propagation from old plants.

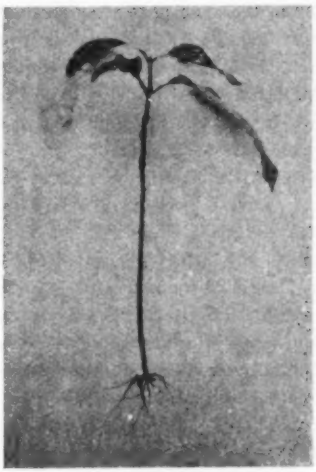

FIG. 1

Photograph of mango cutting, showing root formation by treatment with lanoline solution of 3% indole acetic acid.

Photograph taken after 7 months of treatment.

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Bose Research Institute,
Calcutta,
May 5, 1941.

[1] Guha Thakurta, A., and B. K. Datt, *Curr. Sci.*, 1940, **9**, 77.

A NOTE ON THE EMBRYOLOGY OF *SCOPARIA DULCIS* LINN. AND *ANGELONIA GRANDIFLORA* C. MORR.

Srinivasan[1] has recently published a paper on the embryology of *Angelonia grandiflora* and some other plants of the Scrophulariaceæ, in which he makes the following statement regarding *Angelonia*: "The antipodals are ephemeral and degenerate soon after fertilisation. The

behaviour of the synergids after fertilisation is interesting. They do not degenerate after fertilisation, as in the case of the other members of the family, but persist till comparatively late stages in the development of the embryo. The synergids are seen clearly in post-fertilisation ovules, which have increased in size considerably." Further, on pp. 216–7 of the same paper, the author writes that "so far as is known, the only other genus of this family, where haustoria do not occur is *Scoparia*.[2]" On looking up the paper of Schertz one finds that he has worked on *Scrophularia marylandica* but incidentally mentions that in *Scoparia* no haustoria are "noticeable".

Raghavan and Srinivasan[3] think that the statement made by Schertz is justifiable on the basis of Srinivasan's work on *Angelonia* and add the suggestion: "It is quite likely that in such of those few forms, where true endospermal haustoria do not occur, the synergids come forward and take up the role."

The presence of persistent synergids and the lack of endosperm haustoria in a member of the Scrophulariaceæ seemed so unlikely that immediately on reading the above, we decided to investigate the point ourselves. Material of *Scoparia dulcis*, fixed several years ago at Agra and Allahabad and imbedded in paraffin, was available in abundance and about a hundred ovaries of different stages of development were sectioned. In no case did we find any haustorial synergids. They are certainly quite prominent in pre-fertilisation stages but begin to degenerate soon afterwards and disappear long before any divisions have taken place in the zygote. Endosperm haustoria, both chalazal and micropylar, are present as usual. A detailed report will be published elsewhere.

Unfortunately, the material of *Angelonia* that was available to us showed only prefertilisation stages which go through normally. The flowers fall off soon after opening and although the ovaries sometimes showed a little swelling, sections revealed only degenerated embryo-sacs. It may be noted that at Dacca this plant is propagated entirely by cuttings.

A study of Srinivasan's figures shows that not only are the synergids persistent (Figs. 20–23) but the endosperm consists of a single row of about half a dozen cells (Fig. 20) which later divide in all planes to form an irregular mass (Figs. 21–23). It is disappointing that Srinivasan does not figure the first and second divisions of the primary endosperm nucleus in *Angelonia*, although he regards his study of this plant as the main contribution of the paper. A much closer series of figures is given in the case of *Dopatorium*, *Stemodia* and *Vandellia*, although they are essentially normal and, judging from the title, form only a subsidiary part of his work.

We believe that *Angelonia* should be re-investigated, preferably with the help of material obtained from its native habitat. If the abnormalities reported by Srinivasan are substantiated, it will certainly have to be regarded as a *very* aberrant member of the Scrophulariaceæ.

Incidentally it may be mentioned that Srinivasan's method of grouping his figures and giving their legends puts the reader to the maximum amount of inconvenience. For example, the explanation for Fig. 28 follows that of Fig. 33, while this in turn is followed by Fig. 35. Fig. 34 follows Fig. 36, while no legend whatever could be found for Fig. 38.

P. MAHESHWARI.
H. S. NAVALAKHA.

Dacca University,
Dacca,
May 10, 1941.

P.S.—After this had been written out, we received the April number of *Proc. Ind. Acad. Sci.*, 1941, 13, containing a paper by Raghavan and Srinivasan on *Scoparia*. This confirms our own observations on the plant and we hope that the authors will now re-investigate *Angelonia*.

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[1] *J. Ind. Bot. Soc.*, 1940, **19.**
[2] Schertz, *Bot. Gaz.*, 1919, **68.**
[3] *Proc. Ind. Acad. Sci.*, 1941, **B 13.**

DISCOVERY OF CELESTITE IN THE TRICHY DISTRICT

In a recent publication of the Geological Survey of India,[1] Dr. Krishnan has made some erroneous observations on the discovery of celestite in the Trichinopoly District.

The Trichy Mining Works did not at any time send to the Indian Institute of Science any specimens of celestite for analysis; the 'lump' referred to in our note in *Current Science*[2] was picked up by me for examination while on a tour in the area of occurrence. The Trichy Mining Works, therefore, cannot be credited with any share for the discovery of celestite. It must also be pointed out that our estimate of one million tons of celestite as published in *The Hindu* (daily edition 4–1–1940), refers to the whole area and not to the restricted area of 1,500 acres.

Regarding Dr. Warth's observation on the occurrence of celestite, his note was not in any published form, but remained in the Government files only. Therefore the claim of the authors[2] for the discovery of celestite, cannot be invalidated, as has been attempted by Dr. Krishnan.

In this connection, Dr. Krishnan[3] is again wrong in quoting us as stating that both *strontium sulphate* and strontium carbonate occur as thin plates filling the cracks in the phosphatic nodules collected from Utatur area. We have made no reference to strontium carbonate, but reported only celestite. Our estimate of the celestite in the phosphatic nodules, as up to 3 per cent. and "even 10 per cent. in exceptional cases" is in no way high. Our estimates are based on systematic quantitative physical and chemical studies of large quantities of phosphatic nodules, and not on the basis of the rough "hammer tests". There has been besides no mistaking of gypsum for celestite, as gypsum occurs mainly in the non-phosphatic nodules while celestite, as a rule, occurs in the phosphatic nodules.[4]

Finally, the statement of Dr. Krishnan about a possible mistaking of fibrous calcite for strontianite is quite unfounded. I have clearly noticed the widespread occurrence of the brown fibrous calcite. Strontianite occurs, though only to a limited extent and largely mixed up with celestite and other impurities, as small grey or yellow fibrous, or earthy appearance, and has been identified only after detailed chemical studies. It has never been maintained that strontianite occurs in enormous quantities in the Trichy area.

N. JAYARAMAN.

Dept. of Pure & Applied Chemistry,
General Chemistry Section,
Indian Institute of Science,
Bangalore,
June 4, 1941.

[1] *Rec. Geol. Surv. Ind.*, 1941, **76,** Bull. No. 3, 9 and 10.
[2] *Curr. Sci.*, 1939, **8,** No. 12, 553.
[3] G. O. No. 735, (10–4–1941), Development Dept., Government of Madras.
[4] *Jour. Ind. Inst. Sci.*, 1940, **23A,** Part II, 11–20.

PROF. BAWA KARTAR SINGH

We have great pleasure in congratulating Professor Bawa Kartar Singh, M.A., Sc.D. (Cantab.), Sc.D. (Dublin), F.I.C., I.E.S. (Retired), of the Allahabad University, on the award of the Sc.D. degree of the Cambridge University. This is an exceptional distinction and is a just recognition of the great services rendered by the Professor to the advancement of chemistry and chemical education in India. After a distinguished career both in India and in England, Prof. Singh served respectively at Dacca, Lahore, Cuttack and Patna, before being called upon to occupy the Chair of Chemistry at the Allahabad University in 1940. Wherever he was, his abounding enthusiasm for research outstripped the limitations of heavy administrative duties and any lack of facilities for research, and resulted in a volume of work on optical activity, phototropism, optically active dyes, and other chemical subjects. Prof. Singh has earned several academic distinctions. He was President of the Chemical Section of the Indian Science Congress in 1920, President of the Indian Chemical Society 1931–32, and Vice-President of the Indian Academy of Sciences 1934–40.

REVIEWS

Methane, Its Production and Utilisation. By J. P. Lawrie. With a Foreword by Lord Strabolgi. (Chapman & Hall, Ltd., London), 1940. Pp. 66. Price 6*sh.*

This book is a publication of topical interest. Frequent attempts have been made to use methane as an alternative to petrol in countries which do not command natural resources in mineral oil. It is stated that in Germany alone 22,000 vehicles have been converted to operate on methane gas in the last two years. French manufacturers have developed a gas container weighing 245 lbs. which can hold 700 c.ft. of methane gas at 3,000 lbs. per square inch pressure equivalent to 5 gallons of petrol. The use of this gas as fuel for stationary engines is also rapidly increasing.

Dr. Lawrie has made out a very good case for the development of the potential supplies of the gas from collieries, coke-ovens, and also from the biological treatment of sewage. In India, this biological process has a special significance for national economy both in times of peace and war. In this connection the work of Barker on methane producing bacteria is stated to be quite promising. Figures from one of the largest sewage works in Europe—The Mogden Works of the West Middlesex Drainage—indicate that it is possible to produce 1,350,000 c.ft. of this gas per day for a population of 1,250,000 and use a large portion of this gas for the generation of power. This book is commended to industrialists and public health authorities for careful perusal. J. C. G. and S. C. P.

The Travancore Tribes and Castes. Vol. III. *The Aborigines of Travancore.* By L. A. Krishna Iyer. Trivandrum, 1941. Pp. 176 + x. Price Rs. 5.

With the present volume the work on the ethnography of Travancore which the author undertook some years ago comes to its conclusion. What his father, the late Dr. L. K. Anantakrishna Iyer did for Cochin and Mysore, Mr. Krishna Iyer has now done for Travancore, and he has done it with an enthusiasm which is specially required in a rapidly expanding science such as Anthropology, and with a receptiveness to criticism which is not a very common virtue among the tribe of scribes. In the present volume he gives a generalised summary of such topics as tribal traditions, racial affinities, megalithic monuments, domestic life, exogamy, marriage, taboo, inheritance and social organisation, disposal of the dead, religion, occupation and clash of culture, most of which have been discussed separately under the different tribes in the previous two volumes. The last chapter on clash of culture is of special importance as it deals with some of the most crucial problems intimately connected with the future of these tribes. Apart from its value to the academic anthropologist, books like this are "of inestimable value in pointing out to the Hindu majority the condition of their less advanced fellow country-men and, even of greater importance, those elements of tribal culture which are of permanent survival value".

Prof. Marett contributes a brief but interesting introduction with several suggestions for the benefit of the educated youth of India. In commending a closer study of the diverse types of Indian communities to young Indians, he remarks how ignorant he has found the brilliant young Indians who find their way to Oxford to be, of "their own country and its inhabitants, apart from their own home quarters and home-circle". He prescribes anthropology as a remedy against the narrowness of social outlook prevalent in India. A. AIYAPPAN.

A Manual of Aquatic Plants. By Norman C. Fassett. (McGraw-Hill Publishing Co., Ltd.), 1940. Pp. 382. Price 26*sh.*

The aim of the book is to enable the identification of aquatic plants in a sterile as well as in a flowering or fruiting condition. The region covered is from Minnesota to Missouri and eastward to the Gulf of St. Lawrence and Virginia in the United States. The aquatics of this area when thoroughly dealt with easily serves a much wider area since there is a great similarity or even an identity in the case of several of the aquatics with those of the neighbouring areas. The book is illustrated with good photographs and line drawings of the different plants.

In the first part of the book an excellent key is given, with the aid of which it is possible to run down the names of the plants to be identified. In this key the vegetative structures of the plants are very largely used to help one in the identification, while at the same time the distinctive features of the flower or the fruit are also referred to wherever necessary.

The second part forms the descriptive portion of the plants. In this part, the various plants are dealt with under the different families. Under each family a key is provided for the different genera and under each genus a key is given for the different species.

In the third portion of the book very interesting and useful information—the results of careful field observations—is given regarding (1) the uses of aquatic plants by birds and mammals, (2) the relation of plants to fish and (3) a general animal index in which is indicated the species of plants eaten by each animal. A good bibliography, a glossary and an index are given finally at the end.

The book will form a very useful reference book to the systematist or the ecologist who is interested in aquatic plants. Though the book deals only with the aquatic flora of a portion of the United States, the Indian reader also will find much to interest him owing to the many common features seen in the aquatic flora of our country.

M. O. P. I.

Chemical Composition of Foods. By R. A. McCance and E. M. Widdowson. (His Majesty's Stationery Office, London), 1940. Second Impression. (Medical Research Council, Special Report Series, No. 235.) Pp. 150. Price 4*sh*.

The recent rapid progress in the field of nutrition has brought home the fact that a knowledge of the chemical composition of foods is the first essential in the dietary treatment of disease or in any quantitative study of human nutrition. Sherman's Tables of Food Values, with their many limitations, have constituted so far the most important source of information. Drs. McCance and Widdowson have placed the world under a deep debt of gratitude by bringing out an extensive and authoritative book of great utility. Their book represents the solid and unostentatious work of a team of investigators working for fourteen years under the auspices of the Medical Research Council. Nearly 670 foods have been exhaustively analysed, and more information has been made available by them than that contained in Sherman's Tables. The foods have been analysed not only in the raw state but also as prepared for the table; the analytical figures have been rendered more valuable by the inclusion of the percentage of edible matter in the cooked food. Tables include a description of the food, nature of edible material, edible matter, water, unavailable carbohydrate, sugar, starch, total nitrogen, protein nitrogen, fat, available carbohydrate, calorific value, sodium, potassium, calcium, magnesium, iron, copper, phosphorus, sulphur, chlorine and acidity or alkalinity. In the case of flesh foods, purine nitrogen values are also given. Analysis has also been made of a number of cakes, pastries, puddings, etc., made to standard recipes and described in 14 special pages.

A few pages have been devoted for figures of the various ingredients contained per ounce of the food; this is in addition to the more commonly expressed values per 100 grammes. Figures per ounce have a greater appeal to the laity than percentages. Available phosphorus expressed as a percentage of the total phosphorus and "available" iron also expressed as a percentage of total iron for a few of the foodstuffs are included at the end of the book.

The book should equally prove an invaluable guide to those interested in the dietary treatment of disease and to those engaged in the serious study of human nutrition. This phœnix of quantitative knowledge condensed in 150 pages will undoubtedly constitute what must remain for many years to come the most authoritative Tables of Food Values. The format of the book leaves little to be desired. S. R.

An Inorganic Chemistry. By H. G. Denham. Third edition. (Edward Arnold & Co., London), 1939. Pp. 694. Price 12*sh*. 6*d*.

The book is written in a simple and lucid style. It contains sufficient information for those taking intermediate science in chemistry. The subject is divided into three groups, theoretical, non-metals and metals. The fundamental principles which an

intermediate student ought to learn at this stage are clearly explained with appropriate illustrations. The inorganic chemistry proper under non-metals and metals has been dealt with great discrimination. The experiments which have been described under the study of non-metals and metals are just the experiments which a lecturer requires for demonstrations. The book would have been more appreciated if it had included a chapter on recent advances treated in a popular manner. S. V. R.

The Grasslands of the Argentine and Patagonia. (*Herbage Publication Series, Bulletin* 30.) (Published by the Imperial Bureau of Pastures and Forage Crops, Aberystwyth), 1940. Pp. 49. Price 2*sh.* 9*d.*

This bulletin is the report of a tour of South American Grasslands undertaken during early 1938 by a well-known agrostologist.

A wide range of climatic types have been covered ranging from sub-tropical in the north to cold temperate in the south.

Eight pastoral zones are described in simple non-technical language with a covering map showing their distribution, and each zone is briefly discussed in relation to its vegetation, agricultural or pastoral practices and potentialities.

There follows a series of notes on 23 individual stations visited. Nineteen, rather mediocre, illustrations help the reader in reaching a proper appreciation of the variety of conditions met with.

Dealing as it does mainly with a description of professional large-scale ranching conditions and practices on pastures whose botanical composition differ vastly from our tropical pastures the *Bulletin* is of only limited interest to Indian readers.

It is however worth more than a passing glance if only to bring home once again the ever present menace of soil erosion where mismanagement of land takes place in the struggle to realise immediate profits.

In this case it is very striking that the intensive raising of lucerne leys which have to be reconstituted at frequent intervals has resulted in considerable loss of fertility through failure to return soil losses by adequate manurial treatment and in wind erosion on an extensive scale. 70 years ago the average area under lucerne was 250,000 acres. 20 years ago it had risen to 21,000,000 acres, but during the last few years this tremendous area has shrunk to 13,500,000 acres in 1933–34 owing chiefly to the compulsory retirement of lands once cultivated through drifting sand. When it is realised that the Argentine is dependent on lucerne for final fattening off of her vast herds, the loss of these areas becomes a serious matter, for their recovery is usually beyond the pocket of the private owner and has to be left to the State.

Such examples as this cannot receive too much publicity in India, where erosion is already depleting the basic national capital —soil fertility. J. A. WILSON.

The Breeding of Herbage Plants in Scandinavia and Finland. (*Herbage Publication Series, Joint Publication* No. 3.) (Published by the Imperial Bureau of Pastures and Forage Crops, Aberystwyth), 1940. Pp. 124. Price 4*sh.*

This joint publication of the Imperial Agricultural Bureaux presents the translations of seven papers on the breeding of herbage plants (grasses and pasture legumes) by seven authorities from Sweden, Denmark, Norway and Finland.

This type of work has been in progress in both Sweden and Denmark since the early years of this century, while in Norway and Finland a start was made some 20–30 years later.

Covering these translations is a rather lengthy summary, indicating the lessons to be drawn from breeding work in these northern countries. Each individual crop is dealt with separately.

The highly technical nature of the work described makes it impossible to avoid the extensive use of that technical jargonese which has now become standardised and which—rather unfortunately in my opinion —renders the intelligent assimilation of the subject-matter difficult to the lay reader.

To the plant breeder, however, the publication is of great interest in indicating the aims and objects kept in view in respect of each crop, the methods employed, and the results obtained.

In India, where the breeding of pasture grasses and pasture legumes is almost an unexplored subject, basic issues will have to

be dealt with before proceeding to the more technical work, and such work receives only passing mention.

An interesting account of cytological work done in Sweden during the past 10 years is given. This had for its main object, a systematic endeavour to alter the chromosome number in crop plants so as to obtain more valuable types for cultivation, and was based on various findings, chief among which are those of Müntzing, who found that both auto- and allo-polyploid types *as a rule* are remarkable for a more vigorous type of growth than original types, and that when the chromosome number varies within the cultivated forms of one and the same species, the high chromosome types are universally the most valuable. The four methods by which a change in chromosome number has been brought about are briefly described and this paper is of particular interest to the plant breeder, though it may not belong strictly to his sphere of work.

J. A. WILSON.

THE INDIAN STATISTICAL INSTITUTE

STATISTICAL method and statistical studies have now, without doubt, gained place of importance in academic thought as well as in administrative work. They have even bifurcated themselves already into two almost distinct branches, one chiefly descriptive and enumerative which is connected with economics and administration, and the other primarily analytical which is as much a branch of positive science as applied mathematics. In Europe statistics became a serious subject of study with the rise of modern States and for a long time almost exclusively associated with economic studies. Not until the mathematical theory of errors based on normal distribution was employed in reduction of observations in astronomy (Gauss), anthropology (Quetelet), or even until the ideas of correlation P, χ^2, and exact distribution were extensively used (Galton, Pearson), was a revolution brought about in the world of statistics. Even more recent work such as at Galton Biometric Laboratory in London, Lawes Institute at Rothamsted, Lund Observatory in Sweden, with which many living statisticians are associated, has definitely enthroned statistical analysis as the touchstone in all experimental work in which a multiplicity of factors is a predominant feature. Societies for the scientific study of statistics exist in all important countries, and the oldest among them, the Royal Statistical Society of London, has already celebrated its centenary.

Statistical studies in India may be traced to classic period of Sanskrit Culture, and to Kautilya's *Arthasastra*, or *Ain-i-Akbar*, and brought down to 1871 when the Government of India opened a separate Commercial Intelligence Department. In modern times the Government of India have made extensive arrangements for the collection of a large amount of primary statistics relating to agriculture, population, public health, vital statistics, finance, trade and commerce, transport, meteorology, and various other things of departmental or semi-analytic kind. On *ad hoc* basis advanced studies and researches particularly in analytic statistics were being done by various persons in the country, and not until 1931 was the question of starting a society even discussed by the workers. In that year a draft constitution for an All-India Statistical Institute was printed and received favourably, and on the 29th February 1932, it was actually put into operation with the Headquarters of the Society at Calcutta. The Ninth Report of this Society embodying the work for 1940–41 has just been published.

As in previous years the work of the Institute consisted of four distinct departments, Statistical Inquiries, Training and Examinations, Research, and Annual Conference.

A large number of enquiries from all parts of India was attended to during the year under review. The distribution by subjects and by provinces is given below:—

By Subjects: Agriculture 81; Anthropology 3; Economic and Business Statistics 30; Education 17; Forest Research 7; Industry 11; Mathematical Statistics 12; Medical 20; Meteorology and Irrigation 14; Miscellaneous 20. Total 215.

By Provinces: Assam 10; Bengal 86; Bihar 2; Bombay 9; C.P. 6; Central Government 31; Madras 6; Orissa 5; Punjab 7; Sind 8; U.P. 33; Others 12. Total 215.

During last year 16 officers from Bengal, Bombay, Burma, U.P., Punjab, and Sind came on deputation to the Institute for training in statistical theory and technique. Mr. K. Raghavan Nair was in charge of this section. The examinations for Statisticians' Diploma Part I and Computer's Certificate Part I were held from 8th to 12th January 1941. There were nine candidates for the diploma and three for the certificate examinations. The Board of Examiners consisted of Prof. K. B. Madhava (Mysore University), Dr. P. V. Sukhatme (Delhi), Mr. R. C. Bose (Calcutta University) and Prof. P. C. Mahalanobis.

Theoretical researches were focussed on the following topics: (1) measures of statistical divergences with appropriate exact distribution; (2) design of experiments; (3) design of large-scale sample surveys and model sampling experiments with non-normal populations. Under the leadership of S. N. Roy the sampling distribution on the null (or equal dispersion) hypothesis of a set of p-statistics which form the appropriate measure of the divergence in the case of multi-variate problems was worked out. The case of heterogeneous dispersion was also investigated. Prof. Fisher in a letter written in 1940 characterised this work as one of the most important recent advances in Statistics. Imported contributions were made to the mathematical theory of the design of experiments by R. C. Bose, K. R. Nair, K. Kishen and others. Interesting relations were obtained between fundamental simplex at infinity in space of n-dimensions and components of main effects and interactions which marked an advance towards the solution of the problem of confounding in the general factorial design. The sampling survey, which is now recognised to be the most efficient method for large-scale enquiries, has continued to engage a good deal of attention; and important advances have been made in the technique of such surveys. The mathematical theory is based on the joint use of two important functions, namely, the variance (or error) function and the cost function. The chief object is to determine the optimum size and number of sample units and the best way of distributing them over the whole area under survey in such a way that the precision of the final results may be as high as possible at any assigned level of expenditure. This method has been applied to jute census, paddy, sugarcane, wheat and other crop estimating survey.

The Fourth Session of the Indian Statistical Conference was held at Benares, 1941. It was opened by His Excellency Sir Maurice Hallet, Governor of the United Provinces of Agra and Oudh. The Hon'ble Sir Girja Shankar Bajpai, Member-in-Charge of the Department of Education, Health and Lands, Government of India, in his address as General President emphasised the social value of Statistics. He exhorted statisticians to proclaim their purpose and explain their activities in language that was intelligent to the ordinary citizen; and pointed out the need for generous financial support from Government and public-spirited industrialists and persons interested in national welfare. Numerous papers were read. Also several joint sessions with the Indian Science Congress were also held; with Anthropology Section (Prof. K. P. Chattopadhya presiding), with Mathematics and Statistics (Dr. C. W. B. Normand presiding), Medical Section (Dr. J. B. Grant presiding), Agricultural Section (Mr. K. Ramiah presiding). Discussions on Applied Economics with Prof. K. B. Madhava in the chair and on Teaching of Statistics with Prof. V. V. Narlikar in the chair were also conducted.

The work of the Institute in the matter of popularising the study of Statistics among students and businessmen was spread over in the five local branches at Bombay, Poona, Madras, Mysore and Lahore, but the chief developments were at Headquarters of the Institute in Calcutta under the direct guidance of the selfless and indefatigable Secretary, Professor P. C. Mahalanobis. His devotion, his work and enthusiasm has received the continuous and sustained support from all academic persons as well as important departments of the Provincial and Central Governments; in particular, this year he was appointed Chairman of the Nagpur Textile Enquiry Committee by the C.P. Government to examine the question of dearness allowance, and was also member in the Indian Central Cotton Committee, Imperial Council of Agricultural Research, Special Entomological Committee, Bengal Board of Economic Inquiry Committee, Bengal Agricultural Research Committee, Price Control Advisory Board of Bengal and several others.

K. B. MADHAVA.

ROSHA GRASS OIL

BY
PROF. JAI CHAND LUTHRA
(Punjab Agricultural College, Lyallpur)

A NUMBER of oil-yielding grasses are found in India. The more important of these are:

1. *Cymbopogon martini* Watson (Motia and Sofia varieties).
2. *C. nardus* Rendle (Citronella oil).
3. *C. citratus* Stapf (Lemon grass).
4. *C. flexuosus* (Nees) Watson.
5. *C. schocnanthus* Spreng (Camel grass oil).
6. *Vetiveria zizanioides* Nash (Khaskhas).

C. martini Watson is widely distributed in India and its use as a fragrant oil appears to date back to an early period. The refined product is technically known in the trade as Palmarosa oil.

India has been exporting Palmarosa oil for many years to Europe and America and has had almost a monopoly of it. Palmarosa oil is used as a base for the manufacture of perfumes on account of its principal constituent Geraniol of which it contains about 90–95 per cent. It is also used for scenting toilet soaps. The demand for Indian Palmarosa oil has declined a good deal on account of other countries, *e.g.*, Java, having taken up the cultivation of Citronella grass as a source of Geraniol. The Rosha grass oil is, however, of superior quality and fetches higher price. But in spite of this advantage, India appears to be losing its overseas market. The position, therefore, requires attention. In some parts of India the manufacture of perfumes has been started and Palmarosa oil has begun to be used for that purpose. With the availability of this oil there is obviously a great scope for such industry here.

To establish the industry on a firm basis it is necessary to cultivate the grass, because not only will the yield be increased by cultivation but also the selection of the variety *motia* will ensure supplies of the best type of geraniol. The late Prof. Puran Singh, Chief Chemist, Forest Research Institute at Dehra Dun, realised that there was a future for this industry. He obtained 400 acres of land on lease and laid out a plantation near Lyallpur in 1924. He succeeded in establishing the grass over an area of 230 acres. He put up a Steam Distillation plant and 3,000 to 3,500 pounds of Palmarosa oil were produced annually. This was the first example of cultivation of an Essential Oil Grass in India. The Punjab, however, does not provide the best conditions for growing it. It is subject to severe frost which kills the grass and reduces its oil content. The grass is grown under canal irrigation and the cost of cultivation is also high on account of water and revenue charges. There are localities in other provinces more suitable than the Punjab and as it offers a great scope for a flourishing indigenous industry, experiments should be conducted for cultivating it. Places with an ample rainfall would be most suitable, as the cost will be considerably reduced.

Rosha grass is a perennial plant. It attains a height of about 6–8 feet. The aerial parts die in winter. Being very susceptible to frost, its leaves and shoots may dry up even in November when there is early frost, but usually withering starts in December, and by the end of January, the plant dries up completely. The dead stumps of the plants are burnt to make room for new shoots. The root stocks sprout in spring and by the middle of October the grass is in blossom and cut for distillation.

The flowers contain a higher percentage of oil (1·4 per cent.) than other parts. The leaves also contain about 1·4 per cent. oil while in the stalks, percentage is as low as 0·03. An acre of the grass yields 15–20 lbs. of oil. Frost causes a loss which may amount to 54 per cent.

Full analysis of a sample of palmarosa oil supplied to me by Dr. S. Krishna, D.Sc., Bio-Chemist, Forest Research Institute, Dehra Dun, U.P., is as follows:—

Colour and odour—Light yellow, pleasant odour.	
Specific Gravity at 20° C.	0·8822
Refractive index	1·4663
Angle of rotation	+ 0·21
Solubility in 70% alcohol	2·2 parts
Acid value	1·74
Ester value	14·93
Ester value after acetylation	276·27
Corresponding to:—	
Total geraniol	95·83%
Free geraniol	91·68%

Higher acid value indicates that some de-esterification has taken place, which is confirmed by the rise in free geraniol.

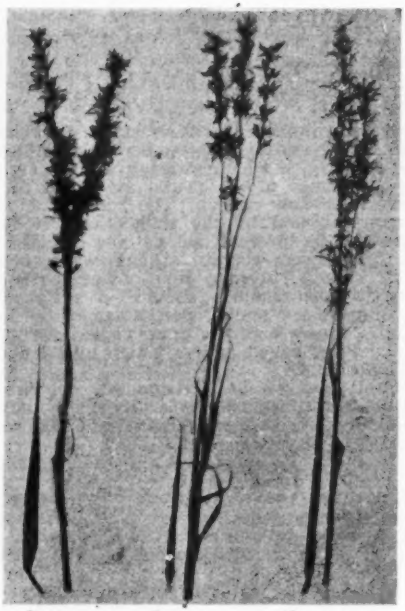
Botanical studies of the plantation have furnished important results regarding the type composition of the crop. As noted above, the typical plant possessing essential oil of the standard quality and purity is the motia variety of *Cymbopogon martini* Stapf. (Fig. 1). It has, however, been noticed that the grass raised from seed obtained from forests is a mixture of several forms. Eleven types differing in morphological characters have been distinguished. All these types are perennial and have almost the same period of growth as the motia variety.

Type No. 1.—Stalk, medium thick; height, over 6 feet; leaves, 6–10 inches long and green; internodes, 4–6 inches long; inflorescence, dense; spikelets, on slender long stalks. Flowers in early October.

This type is rich in palmarosa oil and gives the best yield. It is the typical motia variety.

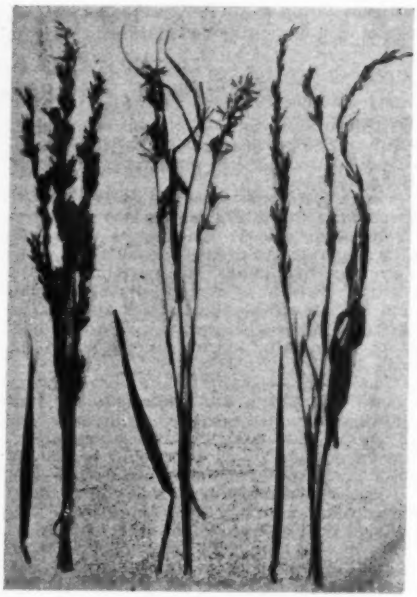
Type No. 2,—Stalks, medium thick; height over 5 feet; leaves, thin, pale green and 6–8 inches long; internodes, 3–4 inches long; it is one of the early flowering types and has a long and lax inflorescence. Flowering starts in early October. Next to No. 1 in oil content.

Type No. 3.—Stalk slightly thicker than types No. 1 and 2; height, about 6 feet; leaves 10–12 inches long, dark green; internodes are 6–8 inches long. The inflorescence is borne on long slender stalks; spikelets, very lax. The inflorescence arises out of the axils of the upper leaves which decrease in size gradually towards the top.



1 2 3

Types of Rosha Grass



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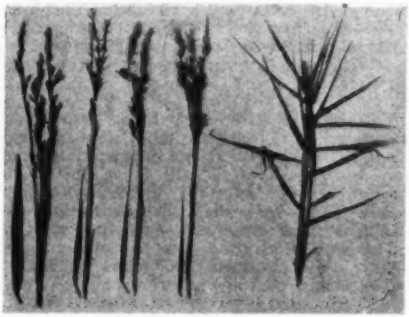
Types of Rosha Grass



7 8 9 10 11

Types of Rosha Grass

Flowering starts early in October.

Type No. 4.—Stalk, coarse and thick; height, over 6½ feet; leaves, 10–12 inches long, very thick, dark green, with pointed sharp ends; internodes short and thick, 3–4 inches long. The inflorescence is borne on stout short stalks and is thick. It is a late flowering variety, and flowers in November.

Type No. 5.—A very conspicuous type with bluish red foliage; stalks medium thick; height, about 5½ feet. The leaves are 6–9 inches long, with closely clasping sheaths covering whole of the internodes, which are 4–6 inches long. It flowers late in December and bears very scanty flowers in lax thin inflorescences; oil content, poor.

Type No. 6.—Stalk, thick and coarse; height, over 6 feet; leaves thin, 8–10 inches long; internodes are 6–8 inches long. Inflorescence is very lax on long very thin stalks. Flowers in early November.

Type No. 7.—Stalk, medium thick; height, about 5 feet; very leafy; leaves dark green, ½–¾ inches broad and 8–10 inches long. Leaf-sheaths are long and clasping; internodes 4–6 inches long; flowering scanty; inflorescence is short and spikelets lax. Flowers in early October.

Type No. 8.—Stalk, thin, dwarf, bushy type; height 3½ feet only; leaves 4–6 inches long, light green, turning brown at maturity and are borne on closely sheathed internodes; 2–3 inches long. Inflorescence is very short and thin; glumes have reddish colour. Flowers in early November.

Type No. 9.—Another thin stalked, dwarf type, 3¾ feet high; leaves, short and pale green, 4–6 inches long, clasping the stalk rather loosely. The inflorescence is lax and scanty, borne on slender long stalks. Flowering starts early, about the middle of October or even earlier.

Type No. 10.—A thin stalked dwarf type only about 3½ feet high; leaves, scanty, green, 4–6 inches long, on long sheaths; internodes 3–4 inches long. It has got a short, medium dense inflorescence; flowers in October.

Type No. 11.—A very conspicuous dwarf type not exceeding 4 feet in height. Stalk, thick and covered with short, thick, pale-green leaves, placed at right angles more or less to the main stalk. Leaves are 8–10 inches long, and set closely together. Internodes are short, 2–3 inches long only. Very late flowering variety and is very poor in oil content. This is the Sofia variety.

CENTENARIES

Johnson, William Woolsey (1841–1927)

WILLIAM WOOLSEY JOHNSON, an American mathematician, was born of a lawyer and landowner at Owego, New York, June 23, 1841. He graduated at Yale in his twenty-first year and entered the United States Nautical Almanac Office. After two years, he became instructor in mathematics at the Naval Academy and remained as such throughout his life except for his sojourn as professor of mathematics at the Kenyon College, Ohio, during 1870–72 and at St. John's College during 1872–81.

Johnson was one of the founders of the American Mathematical Society. He was a popular lecturer and a clear writer. Between 1869 and 1901 he wrote seven books, of which Indian students would remember *A treatise of ordinary and partial differential equations* (1889). His most voluminous book was *The elements of differential and integral calculus*, 3V. (1874–76).

Johnson died May 14, 1927.

Cullingworth, Charles James (1841–1908)

CHARLES JAMES CULLINGWORTH, a British gynæcologist, was born of a bookseller at Leeds June 3, 1841. After school education and a few years' employment in his father's business, he had a brilliant career at the Leeds School of Medicine and became M.R.C.S. in 1865. After a short spell of private practice in rural areas, he entered the Manchester Royal Infirmary in 1867. His special work began in 1873 when he was appointed honorary surgeon to the St. Mary's Hospital for Women and Children at Manchester. In 1885 he became Professor of Obstetrics and Gynæcology in the Owen's College. In 1888 he migrated to London as obstetric physician of St. Thomas's Hospital.

In 1902 Cullingworth delivered the Brodshawe lecture on *Intraperitoneal hemorrhage incident to ectopic gestation*. He was one of the founders of the Obstetrical Society of London and of the *Journal of Obstetrics and Gynæcology of the British Empire*.

Cullingworth was prominent in the movement for the registration of midwives. When the Midwives Act came into force in 1902, he was appointed to the Central Midwives Board. He was a great pioneer in gynæcology. His most original book was *Clinical illustrations of the diseases of fallopian tubes and of tubal gestation* (1895). The views expressed by him in 1892 in a paper entitled *The value of abdominal section in certain cases of recurrent peritottis based on personal experience of fifty cases* were greatly discussed and were ultimately accepted.

Cullingworth died in London May 11, 1908.

S. R. RANGANATHAN.

University Library,
Madras.

THE INTER-UNIVERSITY BOARD, INDIA

THE brief Report of the Proceedings of the Sixteenth Annual Meeting (Trivandrum, 1941) of the Inter-University Board, recently published, contains as usual, several items of interest to those who are concerned with the development of higher education in India. It sets forth the opinions of the various universities of India on certain matters, and the decisions of the Board as a whole in regard to certain others. Special reference may be made here to three of the most outstanding problems considered by the Board: Military Training of university students, mutual recognition of degrees among Indian universities, and reorganization of secondary education.

In the present unsettled state of the world it is but natural that the question of imparting military training to students should have come to the forefront. Apart from the more general question of maintaining physical fitness among the educated classes, the problem of defending the country against foreign aggression seems to demand immediate consideration. In this connection, therefore, the Board has done well to suggest not merely the further extension of the presnt U.T.C. arrangements but also the introduction of military science as a subject of study in college classes. This is a sound move provided, of course, it is not thought that a nation can be rendered militarily efficient by reading about military matters in books.

The mutual recognition of degrees among Indian universities is undoubtedly a most desirable step. The want of such recognition has adversely affected students in the pursuit of higher education, retarding their free migration from one university area to another. After all, when the question is squarely put as to what has prevented, and still prevents, Indian universities from taking this step, perhaps the answer in most cases will be, not any desire to claim superiority, but some administrative trifle, or mere parochialism, which is altogether out of place in the academic world. The sooner this anomaly is removed the better for education.

The reorganization of secondary education is by far the most important question discussed by the Board. It is a problem, however, whose solution cannot be regarded as having been achieved, in spite of repeated consideration by the Board at three separate sittings. Resolution

XVIII recommends the bifurcation of high school studies into a vocational and an academic course; and in Appendix K is found the Press Communique of the Government of Madras setting forth the manner in which they have attempted to solve the problem for that province. It must however be pointed out in this connection that a merely educational approach to the problem is bound to fail; an economic apprcach is necessary. There is no use of turning out vocationally qualified persons unless vocations were made available for them.

Finally a word must be said about the language of the publication. In a Report which purports to set forth the deliberations of such a learned body as the Inter-University Board one expects that the English, like Cæsar's wife, must be above reproach. But apart from ridiculous printer's devils such as the 'Massage' of the Maharaja of Travancore (p. 4), there are other errors which ought not to have been allowed. Thus, for instance, 're' (p. 11) must be written in full as 'regarding', or it must be italicised; 'para' (p. 24) must be 'paragraph'; 'Inter' (p. 17) must be 'Intermediate'. Consider the wording of the following sentence (p. 10):

"It was also noted that if any University wants to nominate a representative in addition to those above mentioned at their own expense, the Board had no objection."

This sentence furnishes an excellent example of an exercise for correction (which may be set) in the Englishr composition paper at the Intermediate examination of an Indian university.

D. S. GORDON.

SCIENCE NOTES AND NEWS

Archaeological Finds in Mexico.—The news of what is described as the "most spectacular" discovery in three seasons of Mexican explorations, has been announced by Matthew W. Stirling, leader of the Geographic-Smithsonian expedition, which recently carried out extensive excavations in Southeastern Mexico. According to a news bulletin issued by the *National Geographic Society*, a cache of more than 700 jade objects, including a number of human figures, pendants, axes, heads, large tubular and spherical beads and other objects, was unearthed.

The Geographic-Smithsonian expedition has been seeking clues to the origins of the ancient Indian civilizations of Middle America. In its first season it unearthed a colossal stone head, and a monument carved with Maya Indian symbols which scientists considered to be the earliest recorded date found so far in the Western Hemisphere. By one correlation that date is equivalent to November 4, 291 B.C., and by another, November 4, 31 B.C.

The Geological Origin of Burma.—Broadly speaking, the origin of Burma with its present configuration of land and sea and surface features can be traced back to an era starting from the Cretaceous period and ending at the close of the Tertiary era. It was during this period that the rising of the Himalayas from the Tethys sea took place. Burma, which had been subjected to a series of submergences and elevations, was still submerged during the early stages of this period. Just then huge tectonic movements, acting almost simultaneously with thcse which were responsible for raising the Himalayas from the floor of the Tethys, brought into being the Arakan Yoma range and the Shan plateau which even to-day are the most prominent features of the topography of Burma. Between these two was formed a central gulf elongated in a direction N-S and occupied by a shallow sea. The major portion of Burma as it now is, was then covered by this gulf which was connected to an ocean in the south. There is no evidence to prove that it was actually connected to the Tethys. (*Geol. Sur. Ind.*, 74, pt. 1.)

During the whole of the Tertiary era this gulf was being filled up with river-borne sediments from the north and by marine sediments in the south, with the consequence that the sea occupying this gulf slowly receded southwards and most of the 'Central Belt' of Burma became a land-mass by the close of the Tertiary era. At intervals this gradual infilling of the gulf was interrupted by light folding movements. It was in this gulf and at this period that the oil-bearing rocks of central Burma were deposited. N. JAYARAMAN.

***p*-Aminobenzoic Acid.**—A preliminary account of the experiments on the nutritional significance of p-Aminobenzoic acid has been published by Dr. S. Ansbacher in *Science* (1941, No. 2407, pp. 164–65). According to the data presented, this amino acid is a chromotrichia factor for the rat, and a growth-promoting factor for the chick, and is probably one of the factors of the vitamin B complex.

Hundred black cr piebald rats at weaning age were placed on a basal diet and were given a daily supplement of thiamine hydrochloride, riboflavin, pyridoxine hydrochloride, calcium pantothenate, nicotinic acid, inositol, and choline chloride. Definite graying of the fur occurred. Seventy animals which later received a daily supplement of p-aminobenzoic acid recovered within a month while the remaining 30 rats reserved as controls, continued to show achromotrichia.

Experiments with chicks gave definite indication of the growth-promoting potency of this amino acid. Chicks reared on a heated vitamin K-deficient ration showed only a small gain in weight and died within a month, even when

adequate quantities of calcium pantothenate and 2-methyl-naphthoquinone were supplied. Addition of 300γ of p-Aminobenzoic acid to 1 gm. of ration resulted in better growth and the chicks continued to grow even after 2 months.

India's Mineral Resources and the War.—The more important mineral resources of a country, in relation to war are:—(1) *fuels* like coal and petrol, (2) snowfields and glaciers (white coal) which favour development of *water power*, (3) metallic ores for the manufacture of iron and steel and alloys, *e.g.*, ores of iron, manganese, chromium, nickel, tungsten, etc., (4) metallic ores required for military purposes (as in the manufacture of aeroplanes and shells), *e.g.*, Bauxite and ores of copper, zinc, magnesium, lead and tin, (5) gold, (6) refractory materials, such as magnesite, fireclay, bauxite, kyanite, sillimanite and zircon, (7) abrasives, such as corundum, (8) materials for manufacture of explosives, such as salt petre, toluene from coal tar and ammonia from coke ovens, (9) materials for chemical industries like salts, sulphur, pyrites and nitrates, (10) mica for insulation purposes in electrical instruments and wireless installations.

With the help of statistics showing quantity and value of mineral production in India for the five calendar years immediately preceding the present war. Sir Lewis Fermor in a paper appearing in the *Asiatic Review* (Oct. 1940) has discussed the position India occupies in respect to almost all these essential war minerals. Not only do we see India self-sufficient in important war minerals like coal, manganese, oil, mica, iron ore, chromite and bauxite, but she can also export substantial quantities of these important raw materials to Empire countries to meet essential needs.

Bauxite has received some special attention as metallic aluminium is becoming supremely important in modern warfare. Sir Lewis has discussed at length the position of bauxite and the possibilities of its development in India. India, it may be noted, is particularly rich in bauxite deposits of high quality. With cheap water power available in India, these ores could be profitably exploited for the extraction of aluminium.

Chromite.—Much information of value to the industrialist and economic geologist on chromite is to be found in a recent bulletin (*Rec. Geol. Surv. Ind.*, Bull. No. 2) issued by the Geological Survey of India. Students interested in the subject may also refer to the highly useful monograph on "Chromium ore and chromium" recently issued by the Imperial Institute which deals exhaustively with the nature, mode of occurrence and utilisation of chromite.

Chromite occurs in many parts of India, the commercially important deposits being those found in the Zhob District of Baluchistan, in the Mysore and Hassan Districts of Mysore and in the Singhbhum District of Bihar. In these places the mineral occurs mainly as a product of magmatic differentiation and is present as segregation masses, patches and veins in ultra-basic rocks. Its mining in India began in 1903 and up to 1940 a million metric tons valued at about a crore and half rupees was produced, all of it being exported. The Indian output for 1937 was 5 per cent. of the world output, and of the Indian total Mysore contributes about one-half and Baluchistan one-third.

This mineral is used for the manufacture of ferrochrome, metallic chromium for plating, chrome steels and chromium salts. It is also used as a refractory material in furnace linings.

It may be expected that in future the industrial utilisation in India itself of a good part of our output of chromite ore will be undertaken. The Mysore Government has already put up a plant for the manufacture of dichromates and the manufacture of ferrochrome may commence in the near future.

N. JAYARAMAN.

Studies in the Ascorbic Acid Content of Potatoes, Raw and Cooked.—Further studies on the change in the ascorbic acid content of potatoes taking place on cooking which throw light on some of the discordant results obtained by previous workers are reported as the result of work at the Nutrition Division, Department of Agriculture, U.S.A. (Lydia A. Rolfe, *Jour. Agr. Res.*, **61**, No. 5). Incidentally, the ascorbic acid content in different varieties of potatoes in the different parts of potatoes and at different periods of storage are also reported. As the potatoes ripen there is a steady loss of ascorbic acid; Chippewa potatoes analysed semi-weekly for six weeks prior to maturity decreased in ascorbic acid content from 25·5 to 20·1 mg. per 100 grm. There is considerable loss of ascorbic acid in storage, ranging from 14 to 50 per cent. of the original content. The loss is more rapid in the early part of the storage period than later on. It was also found that potatoes in cold storage lost ascorbic acid rapidly. As regards the distribution of the ascorbic acid within the potatoes, it was found that the ascorbic acid content was higher towards the skin of the potato than in the interior and was likewise more at the bud end than at the stem end. Cooking did not alter this distribution. In new potatoes the variation in the ascorbic acid content from tuber to tuber was so great that losses obtained as the result of cooking could not be regarded as significant. Results with stored potatoes show that steaming and boiling unpared potatoes were the most conserving of vitamin C. Baking and pressure cooking caused slightly larger losses while boiling pared potatoes was the least conserving of the vitamin. The maximum loss of ascorbic acid due to cooking never exceeded 25 per cent.

A. K. Y.

Properties of Indian Coals.—The importance of obtaining a detailed knowledge of the physical and chemical constitution of coal with a view profitably to applying these results in its utilisation has been increasingly realised during recent years. The problem has of late engaged the attention of Indian scientists, and, of the various methods adopted to tackle it, extraction by solvents has yielded the best

results. This forms the subject of a paper published by the Geological Survey of India (as Professional Paper No. 10).

Investigations carried on into the action of certain solvents on two Indian Coals—one a caking coal from the Jharia field and the other a gas coal from the Raniganj field—reveal that the caking coal invariably yields higher amounts of extract than the gas coal, and the maximum amount of extract in either case is obtained by the action of Pyridine.

The caking coal is found to contain a less amount of solid bitumen than the gas coal but a higher content of oil-bitumen. For this reason it is very suitable for producing a good metallurgical coke which is of vital importance to the iron-steel industry. The individual constituents of the oil-bitumen and the solid-bitumen have been investigated and the results obtained reveal interesting facts regarding the constitution of coal. After extraction the residue of the caking coal possesses no caking propensities whatsoever.

Unburstable Container for Petrol and Water.—For dropping petrol and water supplies from aeroplanes, with or without the aid of parachutes, an unburstable container has been evolved by Sir S. S. Bhatnagar, Director of Scientific and Industrial Research. The container has been tested by dropping it from heights of 75 to 100 ft. and has satisfactorily withstood the impact of the fall.

The container is made of canvas *cum* plastic compositions, and as large as two-gallon containers have been made which have satisfactorily withstood the impact when thrown from the roofs of the second storey of the Alipore Test House and of the Secretariat Buildings, New Delhi. The Army Headquarters are making further experiments with the container by dropping it from low-flying aeroplanes.

This unburstable bottle has the necessary property of resilience and is petrol and oil proof. It is stated that, apart from its enormous advantage in war time, it can be used as a container for oil paints, oils, etc., even after the war. It is lighter and less liable to damage by impact than a tin can.

The Industrial Section of the Indian Museum, Calcutta, has acquired samples of fibres of commercial importance, *e.g.*, cotton varieties, jute, coir, palmyra, mesta, flax, aloe fibre, rhea or rhamæ, bow-string, sunn hemp varieties, etc. from different provinces of India, Burma and Ceylon. Cotton products are shown in different stages of manufacture from the raw materials to the finished cloth.

The Section has also acquired, for exhibition purposes, a large number of raw and finished silk products from almost all the principal silk producing centres of India.

Fibre Characters in Relation to Spinning Quality of Jute.—The investigations carried out at the Technological Research Laboratories of the Indian Central Jute Committee at Calcutta, on the relationship between fibre characters and spinning quality of jute, have shown that it is possible to predict the quality of the yarn that may be spun from any particular sample of fibre with fair accuracy on the basis of the fineness, strength and flexibility of the fibre. The results of the experiments conducted at the Laboratories, have been embodied in *Technological Research Memoir* No. 2. The practical importance of this work lies in several directions. Thus, since the spinning quality can be predicted from physical measurements made on the fibre, it will be possible to assess the quality of very small samples (say 2 lbs.); this is very important in connection with the work of breeding new strains of jute; it will give information as to what characters in the fibre make for good quality; it will also help in evolving a scientific system of grading the jute fibre.

Momordica Grosvenori is the name given by Dr. Walter T. Swingle to a new drug plant brought out of a remote part of China three years ago by a National Geographic Society Expedition (*vide Curr. Sci.*, 6, 256). A description of the new plant is published in the April number of the *Journal of the Arnold Arboretum* of the Harvard University. The name *Momordica Grosvenori* was given to the plant in honour of Dr. Gilbert Grosvenor, President of the National Geographic Society, who "for many years has encouraged liberally the geographic and botanical exploration of China".

The fruit of the plant, called "Lohan" by the Chinese, has long been used in the dried form in outer China as a house-hold remedy for colds, sore throats, minor stomach and intestinal troubles, and for other ailments. According to a press note issued by the *National Geographic Society*, an expedition of the Society under the leadership of Dr. George W. Groff, of Lingnan University, Canton, explored the mountain regions of northeast Kwangsi Province, in 1937, and found that the plant was a vine and its fruit gourdlike. The plant was identified by Dr. Swingle as a new species of Momordica.

Special importance is attached to Chinese drugs since the discovery, from the Chinese drug "ma huang" of the medicinal properties of ephedrin. This drug was unknown outside China 25 years ago.

Dairy Research in India.—A press note dated 6th May 1941, draws attention to the establishment of a Dairy Chemistry and Dairy Bacteriology Section of the Imperial Dairy Research Institute.

A reorganisation of the Imperial Dairy Department has been effected, and the Director of Dairy Research has taken over from the Imperial Dairy Expert the following duties: (*i*) advising the Agricultural and Veterinary Departments in Provinces and Indian States, and private persons who are engaged in the production and utilisation of milk; (*ii*) testing of dairy products for the public where such tests are of a special nature not normally falling within the duties of public analysts and other similar officials; and (*iii*) the prosecution of research work into problems connected with

the dairy industry, including handling and transport of milk and the utilisation of milk in the manufacture of milk products.

Enquiries on these matters should be addressed to the Director of Dairy Research, New Delhi. The Imperial Dairy Expert will in future be designated as the Dairy Husbandry Officer and Principal of the Imperial Dairy Institute, Bangalore.

Lady Tata Memorial Trust.—The Trustees of the Lady Tata Memorial Trust announce the Awards of the following Scholarships and Grants for the year 1941–42.

I. International Awards for research in diseases of the blood with special reference to Leucaemias:—(1) Prof. Eugene L. Opie and Dr. Jacob Furth, both of American nationality, Cornell University Medical College, New York. To continue the work in progress upon the Leucaemias like diseases of fowls and their relation to neoplasms, and to determine the nature of viruses producing leucaemias and associated neoplasms lymphomatosis, myelomatosis, endothelioma, Sarcomas, etc. (*Grant of* £400). (2) Dr. P. A. Gorer, Greys Hospital, London. To continue the studies in the genetics of mouse Leucaemia. (*Grant of* £70). (3) Dr. A. H. T. Robb-Smith, Nuffield Reader in Pathology and Morbid Anatomy, Oxford University. To continue the aid to the establishment of a "Lymphonode Registry" in the School of Pathology at Oxford to aim at better classification and follow up of human cases showing progressive hyperplasias and neoplasms of the lymphoreticular tissues including cases of the leucaemias, lymphadenoma, lympho sarcoma, etc. (*Grant of* £400). (4) Dr. Werner Jacobson, Part-time Sir Halley Stewart Fellowship at the Strangeways Research Laboratory, Cambridge. To continue the histo-chemical study of the argentaffine cells of the gut epithelium, with a view to determining whether they are the source of the intrinsic factor of castle, and hence their bearing on the problem of pernicious anemia and other blood diseases. (*Grant of* £250; *i.e.*, £200 part-time personal grant and £50 Research expenses).

II. Indian Scholarships of Rs. 150 per month for one year from 1st July 1941 for Scientific investigations having a bearing on the alleviation of human suffering:—(1) Mr. T. J. Job, B.A. (Madras), M.SC. (Lucknow), to continue the work on the "Practical utility of insectivorous fishes in the biological control of mosquitoes." (2) Dr. Sachchidananda Bannerji, M.SC. (Cal.), M.B. (Cal.) to continue investigations "On the comparative methods for determining the vitamin C status of the body and the role of vitamin C in infection". (3) Mr. G. B. Ramasarma, B.SC. (HONS.), A.I.I.SC., to continue research on "Vitamin A, specially provitamins and the role of fat in their absorption". (4) Mr. S. Rajagopalan, M.SC. (Madras), to continue the work "On synthesis of new sulphanilamides". (5) Mr. P. Subraya Sarma, M.SC. (Madras), to do research on "The influence of fats on the absorption of vitamin D and the cure of rickets". (6) Mr. Debabratha Das Gupta, M.SC., to carry on "Research on chemotherapy of bacterial infections". (7) Mr. Nirmal Chandra Datta, M.SC. (Dacca), to carry on "Investigations on certain aspects of role of fat in human nutrition".

Board of Scientific and Industrial Research.—Over fifty schemes of research were considered by the Board of Scientific and Industrial Research at their fifth meeting held in Simla on May 16, 1941, and of these twelve were recommended. Of the latter, mention may be made of the following:—

Manufacture of Carbon Electrodes for the Aluminium Industry, on which work is to be carried out at the Indian Institute of Science, Bangalore.

Application and standardisation of vegetable dyes from certain barks, to be carried out jointly by Mr. M. N. De at the Silk Institute at Bhagalpur and Dr. K. Venkataraman in the Department of Chemical Technology, University of Bombay.

Erection and operation of a pilot plant for the manufacture of butyl alcohol and acetone, by Dr. H. D. Sen and Dr. B. C. Guha at the Imperial Institute of Sugar Technology, Cawnpore.

Four schemes relating to synthetic dyestuffs were sanctioned. These are the preparation of vat colours, by Dr. K. Venkataraman; preparation of mono- and di-alkyl anilines, by Mr. B. C. Roy, University College of Science, Calcutta; investigation of electrolytic methods for the preparation of anilines, etc., by Dr. B. B. Dey, Presidency College, Madras; and manufacture of aniline from chlorobenzene, by Dr. G. P. Kane, Department of Chemical Technology, University of Bombay.

The Board also recommended schemes for the continuation of work on the manufacture of vaccum and compressor pumps by Prof. M. N. Saha, and for the manufacture of sodium cyanide, by Dr. J. C. Ghosh.

Glossary of Technical Terms used in Irrigation Practice.—A revised edition of the publication "Glossary of Technical and Vernacular Terms in Connection with Irrigation in India, together with Standard Notations", has been brought out by the Central Board of Irrigation.

The first edition was issued in 1934, but since that date many additional terms as well as definitions have been formulated.

This publication constitutes a standard reference on definitions of irrigation terms, some of which are extremely complex. Its effect will be to prevent the confusion caused by the employment within India of different terms for the same object.

Herd Books for Indian Cattle.—With a view to establish the cattle-breeding industry on a secure basis, the *Imperial Council of Agricultural Research* at its last November meeting, formulated rules and regulations for the establishment and maintenance of Central Herd Books.

The scheme is restricted in the first instance to Sahiwal, Sindhi, Hariana breeds of cattle and Murrah breed of buffaloes. Applications for registration of animals are invited from

persons who own or breed stocks of these four breeds. The milk yielding qualifications are respectively 3,000, 2,500, 2,000 lbs. for Sahiwal, Sindhi and Hariana cows and 3,000 lbs. for Murrah buffaloes in a lactation not exceeding 300 days in length. No fee will be charged for registration of pedigrees, performance, births or transfers. Necessary forms will be supplied free.

The Annual Report of the **Indian Association for the Cultivation of Science** for the year 1940, includes a brief resume of the work carried out in the Laboratory by Prof. K. S. Krishnan, F.R.S., and his associates. The work carried out here, particularly in the field of crystallographic studies with special reference to Magnetic, Electric, and Optical properties, are well known, and further significant contributions have been made during the year under report. Thus it is found that the conductivity of graphite in the basal plane compares favourably with that of many metals, whereas the conductivity along the perpendicular direction is extremely feeble, and is at least 10,000 times less than the conductivity in the basal plane. Magnetic studies on copper sulphate pentahydrate at low temperatures have also revealed that the copper atom in the crystal is not present as cupric ion but is covalently bound to the four water molecules that form a square around it, so as to give the complex $[Cu(H_2O)_4]^{++}$.

Indian Statistical Institute.—The ninth Annual General Meeting of the Indian Statistical Institute was held on 24th April 1941, in the chamber of the President, Sir Badridas Goenka, who presided.

The meeting approved of the Honorary Secretary's proposal to bring out a popular supplement to the *Sankhya* with a view to presenting to the public an account of statistical investigations of a practical nature in non-technical language.

The Hon'ble Sir Girja Shanker Bajpai, Member-in-Charge of the Department of Education, Health and Lands, Government of India, was elected an Honorary Member of the Institute.

Sir Badridas Goenka was re-elected President of the Institute for 1941–42. Dr. S. C. Law was re-elected the Honorary Treasurer and Prof. P. C. Mahalanobis the Hon. Secretary. Prof. K. N. Chakravarti and Mr. K. R. Nair were elected Hon. Joint Secretaries.

MAGNETIC NOTES

April 1941.—Magnetic activity during the month was much less than that during the preceding month. There were 15 quiet days, 13 days of slight disturbance and 2 days of moderate disturbance as against 13 quiet days, 13 days of slight disturbance and 4 days of moderate disturbance during April 1940.

The most disturbed day during the month was the 24th when a magnetic storm of moderate intensity was recorded. The day of least disturbance was the 27th. Characters of individual days are shown in the following table:

Quiet days	Disturbed days		
	Slight	Moderate	Very great
1, 4, 5, 6, 8, 13, 14, 15, 17, 21, 22, 23, 27, 29, 30	2, 3, 7, 9, 10, 11, 12, 16, 18, 20, 25, 26, 28	19, 24	..

There was only one storm of moderate intensity during the month, the same number as in April last year. The mean character figure for the month is 0·57 as against 0·70 for the same period of last year.

P. P. JOSHI.

Colaba & Alibag Observatories.
Bombay.

ASTRONOMICAL NOTES

The Earth will be in aphelion on July 3.

Planets during July 1941.—Mercury, after inferior conjunction with the Sun on July 3 passes into the morning sky; it attains greatest elongation from the Sun (20° 0′ W.) on July 24, when it will be visible as a reddish star of magnitude 0·4, for more than an hour before sunrise. Venus continues to be an evening star and is gradually separating from the Sun; it will become a fairly bright object low down in the western sky just after sunset. Mars is rapidly moving eastward along the northern border of the constellation Cetus and is also increasing in brightness, it can be seen as a prominent star (of magnitude — 0·7), rising about an hour before midnight.

Both Jupiter and Saturn are in the morning sky and are getting away from the Sun. They will be situated about half way up in the eastern sky just before sunrise. The ring system of Saturn will be seen considerably more widened since last year, the angular dimensions of the major and minor axes being 38″·8 and 15″·6 respectively, on July 15. About three degrees to the northeast of Saturn is Uranus which is continuing its slow eastward march in the constellation Taurus.

The meteoric showers known as Delta Aquarids may be seen about the end of July. The average duration of the showers is three days and the date of maximum July 28. These meteors are observed to have slow long paths, and the approximate position of the radiant is given by R.A. $22^h\ 40^m$, Declination 17° south.

T. P. B.

SEISMOLOGICAL NOTES

May 1941.—During the month of May 1941, 1 feeble, 3 slight and 3 moderate earthquake shocks were recorded by the Colaba seismographs as against seven slight, four moderate and one great shocks recorded during the same month in 1940. Details for May 1941 are given in the following table:

Date	Intensity of the shock	Time of origin I. S. T.	Epicentral distance from Bombay	Co-ordinates of the epicentre (tentative)	Depth of focus	Remarks
May 1941—		H. M.	(Miles)		(Miles)	
6	Slight	22 25	1450			
9	Moderate	11 03	3300			
14	Slight	12 38	1800			
16	Moderate	12 45	1790	Epc. : Near lat. 24°·5 N., long. 101°·0 E., in Yunnan Province, China		
17	Moderate	07 55	6730			
22	Slight	06 30	1450			
28	Feeble	23 16 (Time of first phase)	Local	Epc.: In the neighbourhood of the City of Bombay		Tremor, felt in Bombay City and Ratnagiri

We acknowledge with thanks the receipt of the following:—

"Journal of the Royal Society of Arts," Vol. 89, No. 4584.
"Biochemical Journal," Vol. 35, Nos. 1–2.
"Agricultural Gazette of New South Wales," Vol. 52, Part 4.
"Biological Reviews," Vol. 16, No. 2.
"Journal of Chemical Physics," Vol. 9, No. 4.
"Indian Forester," Vol. 67, No. 6.
"Transactions of the Faraday Society," Vol. 37, Pt. 4.
"Indian Farming," Vol. 2, No. 5.
"Geological, Mining and Metallurgical Society of India" (Quarterly Journal), Vol. 12, No. 4.
"Bulletin of the American Meteorological Society," Vol. 22, No. 2.
"Indian Medical Gazette," Vol. 76, No. 5.
"Journal of Nutrition," Vol. 21, No. 4.
"Journal of the Bombay Natural History Society," Vol. 42, No. 2.
"Nature," Vol. 147, No. 3726.
"Journal of Research," National Bureau of Standards, Vol. 26, No. 3.
"Science and Culture," Vol. 6, No. 12.
"Indian Trade Journal," Vol. 140, Nos. 1821–22 and 1824.

Books

"An Introduction to Kant's Critique of Pure Reason," by N. A. Nikam. (The Bangalore Press), 1941. Pp. 196. Price Rs. 5–8–0.
"Principles and Practice of Chromatography," by A. L. Bacharach and F. A. Robinson. (Chapman & Hall, London), 1941. Pp. 362. Price 25*sh.*
"Spectrochemical Abstracts," Vol. II, by Ernest G. S. Van Someren. (Adam Hilger, London), 1941. Pp. 39.

ACADEMIES AND SOCIETIES

Indian Academy of Sciences: (*Proceedings*)

May 1941, SECTION A.—V. T. CHIPLONKAR: *Rectification in discharge tubes. Part II.* N. S. NAGENDRA NATH AND E. V. CHALAM: *The intensities of the Raman lines in carbon dioxide.* The polarisability of a molecule is assumed to be made up of the bond polarisabilities as functions of the inter-nuclear distances. The idea is applied to CO_2 and the intensity ratio of the Fermi split lines has been calculated. The results are in good accord with experimental observations. C. V. DELIWALA AND N. M. SHAH: *Aluminium chloride, a new reagent for the condensation of ketonic esters with phenols. Part V. The condensation of substituted resacetophenones with ethyl acetoacetate.* S. S. DHARMATTI: *Magnetism and molecular structure of sulphur compounds.* The magnetic method is of great value in fixing the correct molecular constitution and the magnetic susceptibilities calculated by Slater's and Angus's method are in better agreement with the experimental ones. (LATE) N. W. HIRVE, MISS K. D. GAVANKAR AND B. V. PATIL: *Studies in chloral amides. Part X. Reactivity of α-Halogen in α-Halogeno chloral-methoxy nitro-, and bromo-benzamides.* L. A. RAMDAS AND S. Y. JOGLEKAR: *Studies of thermal repulsion*: The thermal pressure is about 1000 times as large as radiation pressure. A thermal filter and a dust counter utilising the above phenomenon have been designed. K. GANAPATHI: *Chemotherapy of bacterial infections. Part IV. Synthesis of (N^1)-sulphonamide substituted heterocyclic derivatives of sulphanilamide.* In an attempt to assess the anti-bacterial effect of sulphanilamides with various heterocyclic rings

introduced into the (N^1)-sulphonamide radical, typical derivatives of guanidine, thiodiazole, uracil, barbituric and pyrimidine have been synthesised. B. R. SETH: *On the gravest mode of some vibrating systems.* P. BHASKARA RAMA MURTI AND T. R. SESHADRI: *The glycosidic components of the flowers of* Butea frondosa. P. BHASKARA RAMA MURTI AND T. R. SESHADRI: *A study of the chemical components of roots of* Decalepis Hamiltonii. *Part III. Comparison with* Hemidesmus indicus (*Indian Sarsaparilla*). T. R. SESHADRI AND V. VENKATESWARLU: *Synthetic experiments in the benzo-pyrone series. Part IV. Synthesis of karanjin.* S. RAMACHANDRA RAO AND K. S. SANKARASUBBA IYER: *Photoelectric efficiency of ferromagnetic metals at different temperatures in the soft X-ray region.* Experiments were carried out at different temperatures, ranging from 30° C. to 950° C. The photoelectric sensitivity of iron is lowered by 10 per cent. in the range 780° to 900° C., while for cobalt and nickel it is constant. The photoelectric effect due to soft X-rays is similar more to the effect with ultra-violet light than to the effect produced by hard X-rays. K. SUNANDA BAI: *Depolarisation of light scattered by liquids.* In the case of 18 liquids, the graph of half slit width (range 2000μ to 10μ) as abscissæ and observed depolarisation as ordinate, is nearly horizontal up to about 10 $cm.^{-1}$, below which it falls off rapidly. The wings in liquids start with maximum intensity at the Rayleigh line and fall off exponentially with increasing wave number shift. P. I. ITTYERAH AND KANTILAL C. PANDYA: *Condensation of malonanilic acid with aldehydes. Part IV. With* o-, m- *and* p-*methoxybenzaldehydes: The influence of a hydroxy-group.*

SECTION B.—RUSTOM JAL VAKIL: *An analysis of normal electrocardiograms.* BENI CHARAN MAHENDRA: *Contributions to the bionomics, anatomy, reproduction and development of the Indian house-gecko,* Hemidactylus flaviviridis *Rüppel. Part II. The problem on locomotion.* SHRI RANJAN AND SANTOSH KUMAR BASU: *Physiological studies on the wheat plant —V. Diurnal variations of total nitrogen and amino-acid nitrogen in* Triticum vulgare. T. S. RAGHAVAN AND K. R. VENKATASUBBAN: *Contributions to the morphology and cytology of* Alpina calcarata *Rosc., with special reference to the theory of zingiberous flowering.*

Indian Chemical Society: (*Journal*)

March 1941.—D. R. KULKARNI, R. L. ALIMCHANDANI AND N. M. SHAH: *The condensation of α-substituted acetoacetates with phenols. Part III. The Pechmann condensation of ethyl α-(α- hydroxy - βββ - trichloroethyl) - acetoacetate.* DEBABRATA DAS-GUPTA AND TEJENDRA NATH GHOSH: *Quinoline derivatives. Part VI.* D. R. KULKARNI, R. L. ALIMCHANDANI AND N. M. SHAH: *The condenasation of α-substituted acetoacetates with phenols. Part IV. The condensation of cresols and other less reactive phenols with ethyl α-(α-hydroxy-βββ-trichloroethyl)-acetoacetate.* G. GOPALARAO AND K. S. MURTHY: *Photosensitisation by solids. Part II. Photosensitised oxidation of ammonia in aqueous solution with titania as the photosensitiser.* SHRIDHAR SARVOTTAM JOSHI AND A. PURUSHOTTAM: *Coagulation of colloids by exposure to high frequency oscillations.* K. V. GIRI: *The influence of vitamin C on the inactivation of enzymes by ultra-violet light.* PANCHANAN NEOGI AND KANAI LAL MANDAL: *Co-ordinated mercury compounds with ethylene and propylenediamines.* PRIYADARANJAN RAY AND JAMINIBHUSHAN ROY-CHOWDHURY: *Biguanide sulphate as a reagent for the estimation of copper.* S. S. GUHA-SIRCAR AND SASANKA CHANDRA BHATTACHARJEE: *The use of nitroso derivatives as reagents in inorganic analysis. Part I.* S. S. GUHA-SIRCAR AND SASANKA CHANDRA BHATTACHARJEE: *The use of nitroso derivatives as reagents in inorganic analysis. Part II.* YEO SEIN GWAN: *A new method of preparation of aceto- and benzonitriles.* M. B. ROY: *A new colorimetric method for the chlorate ion.* U. P. BASU AND S. J. DAS-GUPTA: *A note on certain heterocyclic sulphonamides.*

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